

The Milbank Memorial Fund  
**QUARTERLY**

CONTENTS

	<i>Page</i>
THE INTERNATIONAL CAMPAIGN FOR BETTER NUTRITION <i>F. G. Boudreau, M.D.</i>	103
SIGNIFICANCE OF POPULATION TRENDS TO AMERICAN AGRICULTURE <i>O. E. Baker</i>	121
RHEUMATIC HEART DISEASE AMONG AMERICAN INDIAN SCHOOL CHILDREN IN DIFFERENT CLIMATES <i>John R. Paul, M.D.</i>	135
SCHOOL HEALTH INSPECTION BY TEACHERS <i>Don W. Gudakunst, M.D.</i>	139
FREQUENCY OF IMMUNIZING AND RELATED PROCEDURES IN NINE THOUSAND SURVEYED FAMILIES IN EIGHTEEN STATES <i>Selwyn D. Collins</i>	150
HEALTH INDICES <i>K. Stouman and I. S. Falk</i>	173
ANNOTATIONS	197
World Population: Past Growth and Present Trends <i>Sara C. Bright</i> Diet and the Teeth <i>Henry Klein</i>	

Vol. XV

APRIL, 1937

No. 2

Edited by the Technical Staff

Published quarterly by the MILBANK MEMORIAL FUND, 40 Wall Street,  
 New York, New York. Printed in the U. S. A. Subscription: \$1.00 a year

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## THE INTERNATIONAL CAMPAIGN FOR BETTER NUTRITION

by F. G. BOUDREAU, M. D.<sup>1</sup>

THE advance of science has greatly increased man's power to obtain supplies of food from the soil. It is likely that increased agricultural production has resulted in improved nutrition in many countries. Nevertheless it is common knowledge that in the face of agricultural surpluses crying for a market considerable groups of the population in some countries are in a state of semi-starvation, and even larger groups are undernourished and malnourished. Science has made possible an immense improvement in the standard of living and in the general well-being of all nations. So far man has not been able fully to realize, for universal or even national benefit, the possibilities inherent in his increasing control over nature. This, in a nutshell, is the problem which national and international committees of physiologists, biochemists, economists, producers, consumers, agriculturists, politicians, and statesmen are attempting to solve. Better human nutrition has long been a preoccupation of advanced governments. Today interest in the problem has become the subject of discussion and action in international circles. There is general approval of this international attempt to confront and solve the difficulties which prevent man's enjoyment of the fruits of technical advance. No less an authority than Sir Frederick Gowland Hopkins, the late president of the Royal Society of Great Britain, referring to the League's work in this field in his presidential address, said (1):

Policies concerned respectively with the production, transport, distribution, and consumption of foods will all, we hope, be discussed. They seem to be the very proper business of the League, and, if discussion goes deep enough and is frank enough, it may well do no small service to the interests of peace itself.

<sup>1</sup> Appointed Executive Director of the Milbank Memorial Fund April 1, 1937, formerly of the staff of the League of Nations.

To those who have followed the development of international cooperation, the campaign is doubly interesting. For it constitutes a new approach to problems, such as economic nationalism, which have for long resisted direct attack. And it has brought about among a variety of international political and technical organizations a much closer degree of cooperation than ever previously existed. The reaction of the man on the street will be astonishment when he is brought to realize that in a comparatively few years such extensive and complicated machinery for international cooperation has grown up.

My purpose is to describe as briefly as possible the first hesitating efforts to set this machinery in motion in order to bring about better human nutrition which may carry with it, as Sir Frederick Gowland Hopkins suggests, that greater measure of social justice which is one of the pillars of peace.

*First Steps.* The first scattering shots in the campaign were fired by the League's Health Organization. They took the form of reports on the food of Japan (2), travel abroad under League auspices of a few nutrition experts whose lectures aroused considerable interest, and the consultation of experts on dietary standards (3) and the methods best calculated to detect states of malnutrition (4). Studies promoted by the Health Organization into the influence of the economic depression on health dealt mainly with dietary and nutrition questions (5). Finally the government of Chile requested the League for assistance in an economic and health inquiry into the state of nutrition among its people.

To form its policy in this field and to prepare to give assistance to Chile in its two-sided inquiry, the Health Organization instructed two members of its staff to prepare a report on nutrition and public health (6). In the preface to the report the authors speak of "public health work in nutrition as an integral and highly important part of public health activity in general"; state that "the remarkable advance of the science of nutrition during recent years



demands a new orientation of public health activity," and conclude that "the problem of nutrition is largely a social and economic problem and as such concerns politicians, economists, agriculturists, social workers, *et cetera*, as closely as it concerns the medical profession." The closing words of their report now possess more significance than was attributed to them at the time they were written:

"... we would say that production, distribution, and consumption have hitherto been considered mainly as economic phenomena, without sufficient regard to their effect on public health, but that the fact of the economic depression has directed attention to the gap which exists between dietetic needs, as determined by physiology, and the means of satisfying them possible under existing economic conditions. The general problem of nutrition, as it presents itself today, is that of harmonizing economic and public health development.

*Workers' Nutrition.* This general report received a wide distribution and aroused considerable interest. Socially-minded persons in various countries looked eagerly to Geneva for guidance in their endeavor to improve national nutrition. The subject had a strong appeal for the International Labour Office as the health of the worker depends to a considerable extent on his ability to buy with his wages a sufficient amount of nourishing food. In his report to the Nineteenth Session of the International Labour Conference (Geneva, June, 1935) the Director of the Office referred to the fact that

It is not open to dispute that large masses of people are at present underfed or wrongly fed. . . . Every country is faced with a problem of this kind, but its exploration is only beginning. . . . Looked at from another angle, it is evident that a higher and more variegated standard of food consumption would go far to solve the question of agricultural overproduction. . . .

This question of consumption is not only national but international in its scope. If it is agreed that the only real solution of the problem of economic balance is not through scaling down pro-

duction but in leveling up consumption, then it follows that the best hope of finding a way out of the present troubles is to raise the standards of the millions who are now underfed, underclothed, underequipped. . . . When all other remedies have been clearly seen to fail, it is in this direction that thought will eventually be directed, unless a general regression towards lower standards is accepted as the ironical but inevitable outcome of a civilization condemned to decline through the excess of its own creative ingenuity and technical perfection.

This challenge was at once taken up. The President of the Mixed Advisory Agricultural Committee which acts as an intermediary body between the International Labour Office and the International Institute of Agriculture, stated that the question of overproduction in agriculture as related to a rational dietary standard was deserving of special attention, and the Committee urged that the two international organizations concerned should continue their researches in this field.

*The International Labour Conference Acts.* Further action was taken by the International Labour Conference which met at Geneva in June, 1935. The delegate of Australia, Sir Frederick Stewart, introduced a resolution (8) which was adopted unanimously after Miss Abbot, delegate of the United States; Dr. Ada Paterson, delegate of Australia; and a number of others had spoken in its favor. The resolution drew attention to the fact that nutrition, adequate in quantity and quality, was essential to the health and well-being of workers and their families, that there was considerable evidence to show that in both town and country large numbers of persons were inadequately nourished. Referring to agriculture, the resolution declared that an increase in the consumption of foodstuffs would help to raise standards of life and relieve the existing agricultural depression. The resolution went on to ask the Labour Office to continue its work in this field in collaboration with the Health and Economic Organizations of the League and the International

Institute of Agriculture, with a view to presenting a report to the next Labour Conference.

*The League Assembly Records its Approval.* The ferment was now at work. The demands for copies of the Health Organization's report on "Public Health and Nutrition" grew so heavy that new editions had to be printed. Government delegates and technical experts meeting in Geneva discussed the subject in private. Economists and agriculturists explored its possible repercussions on national economy and agriculture. When the Assembly of the League of Nations met at Geneva in September, 1935, the interest among the delegates was widespread. But the subject was not on the Assembly agenda. Twelve delegations promptly addressed a letter to the President of the Assembly asking that the question of the relationship of nutrition to the health of the population, which had become a social and economic problem of widely accepted significance, and was recognized as having an important bearing on world agricultural problems, should be discussed during the session.

The subject was introduced to the Assembly by the Right Honorable S. M. Bruce of Australia who made a moving and well-documented address during a plenary session. Eighteen states supported the resolution (1) which he moved in the Second Committee. No dissenting voice was raised. The resolution provided for the appointment of a mixed committee including agricultural, economic, and health experts which was to submit a general report on the whole question. The Health Organization was encouraged to continue its work on nutrition, and the technical organizations of the League (which include the Health Organization) were instructed to collect and publish information on the measures taken in all countries for securing improved nutrition, in consultation with the International Labour Office, and the International Institute of Agriculture. The Council of the League, meeting during the Assembly sessions, took measures to give effect to this resolution.

The next international organization to take up the question was

the International Committee for Inter-Cooperative Relations, a private liaison body between agricultural and consumers' cooperatives, which is presided over by the Director of the International Labour Office. This Committee, meeting at Geneva in October, 1935, decided to study certain questions relating to nutrition which are of direct interest to the cooperative movement. During the same month the governing body of the International Labour Office met to give effect to the resolutions of the Labour Conference. It set up a Committee of Experts on Workers' Nutrition (8) consisting of eleven members—five of them experts in various aspects of nutrition, the others representing the three groups in the governing body—governments, employers, and labor.

*Resolutions of the Labour Conference of American States.* My purpose in dealing so fully with procedure has been to give some indication of the size and complexity of the international machinery involved and the great interest manifested by international organizations, both technical and political. However it would serve no useful purpose to describe the results of each of the subsequent meetings of each of the organizations concerned. But for the information of American readers I must point out that the subject was discussed and resolutions adopted at the Labour Conference of American States which met at Santiago-de-Chile in January, 1936 (7). Of the two long and detailed resolutions adopted I need reproduce only two paragraphs:

The Conference notes the following as possible bases for a policy intended to bring about an improvement in nutrition:

(f) The orientation of the economic policy of states in such manner as to take account of the primordial character of biological necessities in the sense of subordinating production, transport, and distribution, both national and international, of foodstuffs of primary necessity, to the nutrition requirements of the population.

(g) The adoption insofar as possible of international health legislation on nutrition questions.

It will be obvious from the foregoing that a rather impressive

amount of work on nutrition was contemplated by a number of the most important international organizations. But this work needed to be based on a scientific foundation, and the Health Organization hastened to enroll skilled workers to lay that foundation. Economists and agricultural experts could not be expected to produce reports on the relation to nutrition of wages, costs, transport, production, consumption, supply and demand, the effects of high tariffs and quota, exchange restriction, *et cetera*, without knowing the quantity and kind of foodstuffs required to maintain and improve the nutrition of the population. True, national standards had been fixed in some cases but these often differed from country to country. Moreover some of them at least—perhaps the majority—were minimal rather than optimum requirements, and as the whole object was to improve nutrition it was necessary to consider these standards anew.

*The Physiological Basis of Nutrition.* The Health Committee of the League proceeded to provide the basis for future work on nutrition by consulting a distinguished group of biochemists and physiologists, who met at London in November, 1935. The chairman of the group was Dr. Edward Mellanby, secretary of the (British) Medical Research Council. Three American experts participated: Professor E. V. McCollum of The Johns Hopkins School of Hygiene, Dr. Mary Schwartz Rose of Columbia University, and Dr. W. Sebrell in charge of the Department of Nutrition in the National Health Institute at Washington. The Commission's report (9) was divided into two parts: the first dealing with energy, protein, and fat requirements; and the second with mineral and vitamin needs. The basic calorie allowance recommended was 2,400 net calories (the amount of energy available from the food actually assimilated) for an adult living an ordinary life in a temperate climate and not engaged in manual work. Supplements for muscular activity were to be added—they vary from seventy-five calories per hour of light work to 300 and upwards per hour of very hard

work. A table of coefficients was supplied to permit the calculation of energy requirements for other ages and for pregnant and nursing women. Protein and fat requirements were then set out.

In the second part of its report the Commission emphasized the fact that deficiencies in modern diets are usually in the protective foods, i.e., those rich in minerals and vitamins, and proceeded to recommend the use of certain of these protective foods for given climatic and dietetic conditions.

*Protective Foods.* "Thus in the United States of America," said the Commission, "where the chief constituents of the daily diet are usually white bread and other foods made from white flour, sugar, and muscle-meats—milk and the leafy vegetables form the most important protective foods." They went on to point out that in Asia where the protein of the diet is either too low in quantity or of poor quality, meat would provide a highly valuable protective food, whereas in other areas where the diet consists almost exclusively of cooked or dried foods, fresh fruits and (or) vegetables are highly important from the point of view of protection. Emphasis was laid on the mineral and vitamin requirements of pregnancy and lactation, and due attention paid to the needs of other adults and children. A series of general recommendations was adopted (advantages of variety in diet, partial substitution of white flour by lightly milled cereals and potatoes, the excessive use of sugar and the great value of milk, fresh vegetables, fruit, and extra Vitamin D). Finally, a list of problems requiring further study was set out, and dietary schemes for pregnant and nursing women, infants under one year, and children from one to fourteen were given in some detail.

The Technical Commission met for the second time in June, 1936, to examine the observations submitted concerning their first report, to take account of the progress made in the study of the problems they had referred to national technical institutions, to consider the desirability of undertaking certain studies on milk as

a food, and to hear the preliminary reports of the health and economic experts who had assisted the government of Chile in its study of national nutrition. The summary I have given above is of the Commission's report as it was modified in the light of the observations submitted from various sources. As regards two of the subjects mentioned by the Commission as requiring further study—assessment of the nutritional state of children, and nutritive food requirements in the first year of life—the Commission proposed that they should be referred to experts and proceeded to record its general views for the guidance of such experts. One of these statements gives a clue to the spirit in which the Commission dealt with the whole subject:

Too often there is a tendency to take as fixed standards of normal nutrition values which are mere averages of the day. . . . However, especially in children, a state of nutrition which is not excellent cannot be called normal. So far as we are concerned, the optimum is the normal.

As regards milk, the Commission described as precisely as possible the types of studies which should be carried out to determine the optimum milk ration at different ages and under different conditions. These should include metabolism laboratory experiments on animals; institutional observations on the health, growth, and development of children; observations made upon large groups of children, as in the elementary schools; and similar observations upon groups of pregnant and lactating women. These recommendations have been referred to national research institutions for study.

*The Nutrition Problem in Chile.* After hearing the preliminary reports of the two experts who had studied the health and economic aspects of nutrition in Chile, the Commission considered the subject from two points of view: first, as an example of the inquiries that might be conducted in other countries; second, as regards the



desire of the Chilean government to utilize the results of the inquiry as a basis for remedial action. Having in mind the first point, the Commission asked that the final report should be communicated to its members. On the second point it made a number of observations of some significance. In its opinion the conclusion was warranted that a part of the population examined is undernourished. Should the Chilean government decide upon a long-range national policy as regards nutrition, it would be desirable to take a series of measures to be coordinated by a central technical body acting under the authority of the government. The Commission would be prepared, if so requested, to collaborate with this technical body. Further action, so far as the Chilean inquiry is concerned, awaits the decision of the Chilean government upon the conclusions and recommendations of the report.

Toward the end of 1936 the Health Committee convened two groups of experts to deal with methods of assessing the nutritional state of children and the nutritive food requirements during the first year of life (10). Dr. Martha Eliot of the United States Children's Bureau, attended both these consultations.

*Workers' Nutrition and Social Policy.* In the meantime the International Labour Office had issued its report on WORKERS' NUTRITION AND SOCIAL POLICY (7), a substantial document which has drawn forcibly to the attention of governments, employers, and workers the need for the application of measures to improve the nutrition of workers and their families, and the potential economic advantages of such a policy. The chapter headings indicate the scope of the report. Some of these are: Nutrition and Occupation, Facts on Workers' Diets, Agricultural Production and Food Consumption (prepared by the International Institute of Agriculture), Social-Economic Aspects of Nutrition, Social Legislation and Nutrition, Agencies and Methods to Improve Nutrition, and Problems of Policy. Important statistical material and a review of national food regulations appear in the appendices.



The report has the great merit of defining the problem as clearly and precisely as possible, a great advantage in a document for the use of experts in so many different fields as well as for governmental authorities.

In the chapter "Problems of Policy" the authors of the report state:

First, large numbers of the working population not only in impoverished or depressed areas but even in the most advanced industrial countries are inadequately nourished. Such malnourishment and undernourishment are not the result merely of temporary dislocations due to an industrial depression, though a depression usually has an aggravating influence. It is a condition found among employed workers in times of normal business activity.

While ignorance of food values accounts to some extent for inadequate nourishment among workers, its main cause is inability to buy the right kinds of foods, especially protective foods. The potential productive capacity of agriculture is such as to supply the foods necessary to improve workers' nutrition, but the fact that this productive capacity has not been used or has been misused is due to maladjustments created by changes in agriculture and in world economy.

The attempt to obtain higher standards of nutrition depends upon the interplay of social-economic factors which affect the supply and demand for foodstuffs. The reduction of production and marketing costs, the removal of trade barriers, and the elimination of undesirable forms of taxation are involved in the attempt to secure relatively low prices for foodstuffs without reducing producers' incomes. An active demand for better foodstuffs, however, is influenced by the size of the national income and by its distribution. After mentioning the influence on nutrition of labor and social legislation and describing the measures applied to improve the diet of various classes of the population the report states:

But many effective ways for improving popular nutrition which

are open to the modern state as well as to voluntary organizations are still to be fully explored.

The report is a storehouse of information and suggestion, reaching beyond the scope of workers' nutrition to the larger factors involved in the social policy of a modern state:

For the development of a special nutrition policy holds out the promise of shaping some economic and social legislation in a more objective way on the basis of standards obtained by scientific research. And the demand for adequate food for all the people may make clear in a new and striking way the need for economic readjustment and development in order to enable everybody to enjoy health and well-being.

*The Coordinating Body.* Finally we come to the Mixed Committee set up by the Assembly in 1935. It includes in its membership agricultural, economic, and health experts and is presided over by Viscount Astor. On the Committee sit representatives of the International Office, the International Institute of Agriculture, the Health Organization's Technical Commission on Nutrition, and a number of others. The American member of the Committee is Professor Edwin G. Nourse of the Brookings Institute. He was replaced on one occasion by Professor Warren C. Waite of the University of Minnesota, and on another by Mr. Harold B. Rowe of Brookings. Miss Faith Williams of the Labor Department sits as the representative of the International Labour Office, and Professor E. V. McCollum as one of the representatives of the Technical Commission.

The Mixed Committee was obviously intended to act as the mechanism of coordination as regards the various international organizations taking part in the inquiry. It was expected to bring together the work of the technical committees and to prepare a report "on the whole question" in which the importance of the constituent elements would be given due recognition. Most im-

portant of all, it was obviously to this Committee that the Assembly looked for conclusions and practical recommendations.

Now it must be remembered that committees of economists have been meeting for years at Geneva, and that the economic policy of many governments has often run counter to the views of economic experts. This is not the place to review recent economic history, but it must be obvious to anyone that the growth of tariff barriers, quotas, exchange restrictions, subsidies to producers, and dumping do not constitute means of promoting world trade. In its work on the economics of nutrition the Mixed Committee will find—has indeed found—that the causes underlying economic nationalism are still at work. Partly on account of this very serious obstacle and partly because such a wide field had to be explored, the Committee was not able to produce a final report with definite conclusions and recommendations before the 1936 session of the Assembly. Its mandate was therefore renewed and it will meet again early in 1937. It must be emphasized, however, that its work goes on steadily in the intervals between meetings.

The preliminary report (1) of the Committee consists of four parts, each a volume of respectable size. Part I is the report proper, embodying the suggestions of the Committee to the Assembly, and giving a general idea of the problems involved. Part II consists of the report of the Technical Commission on Nutrition. The data on nutrition in various countries submitted by governments to the Committee may be found in Part III, while Part IV is a report on the statistics of food production, consumption, and prices prepared by the International Institute of Agriculture.

I shall restrict myself to the quotation of three of the Committee's preliminary recommendations:

The Committee recommended that governments should:

6. Consider what steps should be taken, whether at the public expense or otherwise, to meet the nutritional needs of the lower-income sections of the community, and in particular, the means by

which they might ensure that an adequate supply of food, especially safe milk, should be made available for expectant and nursing mothers, infants, children, and adolescents;

11. Consider whether any modification of their general economic and commercial policy is desirable in order to ensure adequate supplies of foodstuffs, and, in particular, to assist the reorientation of agricultural production necessary to satisfy the requirements of sound nutrition;

12. Coordinate the work done by different authorities which affects the nutrition of the people, and, in the absence of a central authority, set up a special body for this purpose, in order to ensure unity of policy and direction.

*The National Effort.* So far I have been discussing the subject from the international point of view. There is another side to the picture, the reactions of governments to this international movement and the influence on the latter of national activity in this field. It is, of course, quite obvious that national interest in nutrition preceded the international movement, and that the relation of improved nutrition to agricultural income was clearly recognized. But this was the case in only a few countries and those the most advanced. At present the subject in its larger aspects has been brought home forcibly to every government. In a number of countries central nutrition committees have been set up to coordinate action and policy. Scientific bodies are engaged in working out the problems recommended for study by the Technical Commission. The need for adequate food for the purposes of nutrition is replacing anxiety over the disposal of agricultural surpluses. The gains already won are of inestimable value. The hope is that this effort of the governments to utilize the machinery of international collaboration for a humanitarian as well as an economic purpose will lead to even more tangible results, perhaps in the form of conventions regulating and promoting social welfare, lower tariff barriers for needed food products, fewer obstacles in the way of world trade, and greater agricultural prosperity.

*Nutrition and Agricultural Policy.* As far as America is concerned, I must refer to an excellent article (10) on the subject by two authors, one of whom sat on the Mixed Committee of the League. After describing the plight of agriculture after the war, and the measures taken to remedy it, the authors go on to state:

Sizable groups in both the importing European nations and the exporting agricultural countries have now come to realize that the policies thus far followed have not, taken as a whole, furnished a solution to the problem. In the export countries it is held that while the present world crisis is the result of a great many different causes, recovery would be substantially promoted by a lessening of the agrarian protection policies of the European nations and a return to a larger volume of trade between the industrial and agricultural countries. In the importing countries it is suggested that the high food costs are having a measurable influence upon the health and strength of the people, and that when the total costs of the present policy are finally reckoned they will be found to be very great.

. . . . .  
Others with a more humanistic bent have pointed to the vast numbers of poorly nourished and even starving groups in various parts of the world in the face of abundant supplies and low prices in other sectors. The implication is that the real need of the world with respect to agricultural products is not a restriction in their output, but an expansion of consumption through better diets for submerged fractions of the population, and that a subsidizing of consumption is better social policy than restriction of output of farm products.

Having defined the problem and described the League's initiative in this field the authors go on to discuss the obstacles in the path of progress. These, as any intelligent person must appreciate, are enormous. Good food costs more than poor food. But the poorly fed classes spend a larger proportion of their income on food than the well fed. Therefore poverty is one of the main roots of the evil. Moreover it is extremely difficult to change food habits. Agrarian protectionism is based on strong influences—the desire for a

contented farming class, the needs of national defense, the demands of strongly organized groups. Perhaps, say the advocates of the new policy, subsidizing consumption would content the farmers too. A marked increase in animal husbandry even at some sacrifice of acreage under cereals and sugar would serve the purposes of national defense and in addition add to soil fertility.

*Obstacles in the Path of Progress.* National adjustments of this kind are very difficult to bring about. It need surprise no one that international adjustments are even more difficult, for the interests of agricultural and industrial countries may conflict. Nevertheless, economists are working away at the problem in almost every country. Numerous committees are meeting to consider the problem in its purely economic aspects. Economic pressure may possibly bring the answer more quickly than the appeal for better nutrition. Nevertheless, the work being done by international organizations, linking better nutrition with agricultural and economic policy, will not be thrown away even if it does no more than to make all governments conscious of facts which several enlightened governments have long recognized and sought to remedy, the undernourishment and malnourishment of large classes and their relation to agricultural and economic policy.

The authors I have quoted above are sure that good results would follow the efforts to improve nutrition:

Sufficient evidence is now available to warrant the opinion that an improvement of the world's diet along the lines suggested by modern nutritional knowledge would produce large social dividends. Health and strength would be improved and the greater productivity of the working class might well pay substantial economic dividends. These changes would also call for a redistribution of agricultural efforts and in general would benefit agriculture by necessitating a great increase in the production of a number of products.

In view of the grave practical difficulties, "All that may be

expected for a considerable period of time is some acceleration of the tendencies toward improvement already apparent, but even this is worthy of great effort."

*National versus International Action.* In this international campaign to improve nutrition, the real need is for national action. Further research to elucidate still unsolved problems must be carried on nationally. Economic policy will, in the future as in the past, be the primary concern of individual countries. Education must be promoted by the state authorities. But the value of international action is not thereby lessened. National progress may be stimulated and directed along sound lines by the opportunity to exchange ideas, information, and the results of experience with other countries. International agreement on programs of research and on methods of working out nutrition problems will tend to make the results comparable and more generally available and applicable. Finally, cooperation in matters of social and economic policy is needed to permit the different countries to promote national nutrition without thereby losing any of their advantages in world markets.

The relation of better nutrition to peace may seem very remote. But there is no single road to peace, and if in the attempt to improve national nutrition, the governments succeed in promoting a fuller measure of social justice and in doing away in part at least with economic nationalism in the interests of health, it may be that the real objective of the League and of the Labour Office will not seem so remote as it appears to be today.

#### REFERENCES

The reader will find a full account of League and International Labour Office decisions on the nutrition inquiry, in the official records. I refer below only to the most important publications of which copies may be obtained. There are also a large number of mimeographed documents which are not on sale. Volume V, Num-



ber 3 of the Health Organisation's *Quarterly Bulletin* (September, 1936) is devoted entirely to the subject of nutrition.

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As I write, delegates from national committees on nutrition are gathering in Geneva for a meeting which begins on February 22. Miss Hazel Stiebeling of the Bureau of Home Economics, United States Department of Agriculture, represents the American sub-committee set up by an interdepartmental committee consisting of the under-secretaries of the departments concerned with health work, under the presidency of Miss Josephine Roche, assistant secretary of the United States Treasury.



## SIGNIFICANCE OF POPULATION TRENDS TO AMERICAN AGRICULTURE<sup>1</sup>

by O. E. BAKER<sup>2</sup>

THE decline of the birth rate to continuously lower levels is no longer of merely academic concern. Monetary rewards to large families, penalties against the unmarried and childless, fiat against abortion, and appeals to patriotic duty are being tried by more than one European state in a frantic effort to stem the downward trend of the birth rate. Whatever may be the implication of declining fertility in this country, it is generally agreed that fundamental readjustment must be made at least in our commercial structure, which has been geared to the expectation of increasing population. In the present article Dr. Baker expresses a genuine concern over the possible repercussions of the dwindling birth rate on agricultural problems. Other approaches to the problems presented in this paper will be developed in an early issue of the *Quarterly* by Dr. Frank Lorimer, secretary of the Population Association of America.—THE EDITORS.

THE prospect of the early approach of a stationary and later probably declining population in the United States and in northwestern Europe profoundly alters, in my opinion, the long-time outlook for agriculture in the United States. Until recently the farmers have enjoyed a rapidly expanding market for farm products. Prior to the Civil War the population of the nation, and doubtless its consumption of farm products, increased a third each ten years. After the Civil War the rate of increase lessened, until during the World War decade, and the decade of urban prosperity that followed, the increase of population was less than one-sixth each ten years. But exports to Europe were heavy during much of this period, particularly at the beginning of the Century and for a few years following the World War. During the decade we are in, 1930 to 1940, population, almost certainly, will increase not over one-twelfth; and during the decade 1940 to 1950, the increase

<sup>1</sup> An address delivered at a meeting of the Population Association of America, at Princeton University, Princeton, New Jersey, on October 30, 1936.

<sup>2</sup> Senior Agricultural Economist, Bureau of Agricultural Economics, United States Department of Agriculture.

probably will be not over one-twenty-fourth. About 1950, perhaps before, births appear likely to balance deaths; and, unless the restrictions on immigration are relaxed, the crest of the nation's population will be reached. For a few years the population may then be expected to remain almost stationary and later decline, because there are not enough children being born in the nation to maintain its population permanently stationary. The decline should be gentle at first, and accelerate gradually. For a quarter-century the prospect is for an almost stationary population.

A stationary population is probably the most desirable condition, for one reason because a larger proportion of the population is in the productive age groups—20 to 60 or 15 to 65 years of age—than in an increasing or decreasing population. Other factors remaining equal, production and standard of living should be higher. But a declining population, particularly if the decline be rapid, will have serious economic and social consequences, in my opinion—perhaps political consequences also. And if present trends in birth rates continue the decline in population will be rapid a few decades hence.

#### WILL BIRTHS CONTINUE TO DECLINE?

The weight of evidence, it seems to me, favors a continued decline in births for at least two decades at a rate not much less than during the last decade.

1. In Great Britain, a nation where economic conditions and social ideals and institutions are similar to ours, the number of births started to decline in 1909, which is about sixteen years earlier than in the United States, and the decline continues. (*See Figure 1.*) The Registrar General's report for the first three months of 1936 indicates that deaths exceeded births in Great Britain—for the first time since vital statistics have been collected (excluding war deaths)—but during the second quarter of 1936 births again exceeded deaths. The population of Great Britain is near the crest.

In Germany the decline in births started also in 1909, but in 1934 births increased, and a rate of about 18 per thousand population has

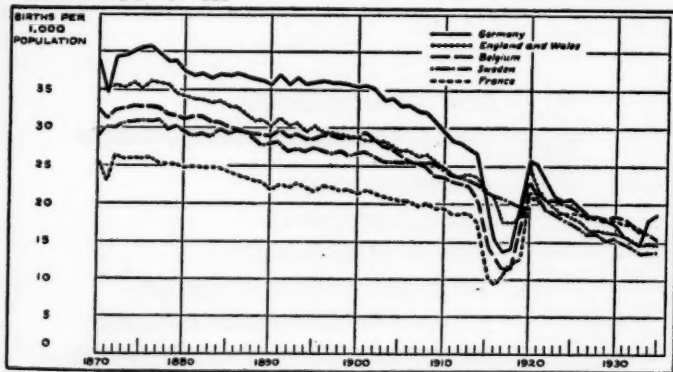
been maintained for two years. Professor Whelpton concludes, I believe correctly, that this increase is attributable mostly to reduction in abortions. How long this birth rate in Germany will be maintained is uncertain.

2. There is a vast number of persons in the lower income groups in the cities of the United States, and probably an even greater number in the rural regions, in which the birth rate is still relatively high. (See Figure 2.) I expect the birth rate will decline for many years among these peoples, as the influence of the philosophy and example of the middle classes in the cities spreads downward and outward.

3. Most of the youth of the nation, so far as I can judge, are not interested in raising a good-sized family. Few children or none is an advantage to the individual from the standpoint of standard of living, particularly in the cities, and unless there is loyalty to a cause the immediate interests of the individual tend to dominate his decisions.

4. The birth rate in the cities is much lower than in rural areas

Fig. 1. Annual number of births per 1,000 population in five countries of north-western Europe, 1870-1935.<sup>1</sup>

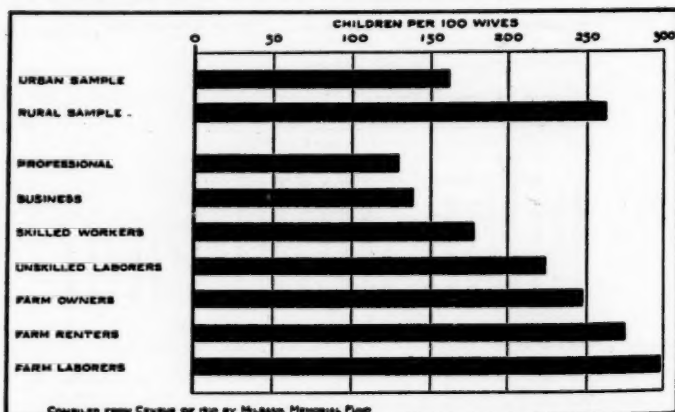


<sup>1</sup> Birth rates are declining in northwestern Europe, which has hitherto provided the principal market for American farm products. The marked decrease in these countries in the years of the World War was merely a dislocation in an otherwise steadily declining trend. This tendency is occurring wherever industrialism and urbanization are important. In Great Britain, for example, the population seems likely to reach a maximum about 1940 and a few years later will begin to decline. The decline will be slow at first but probably will accelerate with the passage of time. Since ten adults are rearing only about seven children, Great Britain in a century may have only one-third of the present population, unless the birth rate rises or there is immigration from abroad.

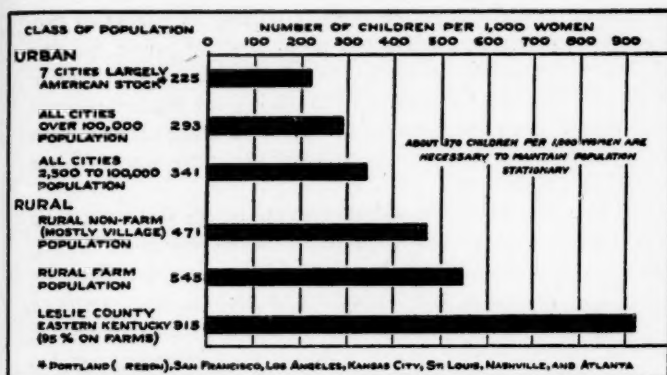
(Figure 3), and the cities are likely to include an increasing proportion of the nation's youth and young married people, because of progress in agricultural technique and migration from farms, at least until the next depression. Even during the depression years 1930-1934 it appears that the net movement from farms was about 600,000, mostly youth. Only in 1932 did the movement to farms exceed that from farms.

5. The crest in the wave of births was during the years 1921-1924. (See Figure 4.) In 1921 nearly 3,000,000 children were born; in 1934, also in 1935, about 2,300,000. For about fifteen years, therefore, the number of women of ages during which most children are born will continue to increase. The birth rate, as measured by the ratio of children under five years of age to women of child-bearing age, has been declining for a century (Figure 5); but until 1921 the increasing number of potential mothers more than counterbalanced this declining birth rate. After about 1950 there will be a decreasing number of potential mothers. The declining number of such women will supplement the decline in births—both factors will work in the same direction.

Fig. 2. Children born per 100 wives under 45, for social classes in selected northern and western cities and rural areas of the United States in 1910.<sup>1</sup>



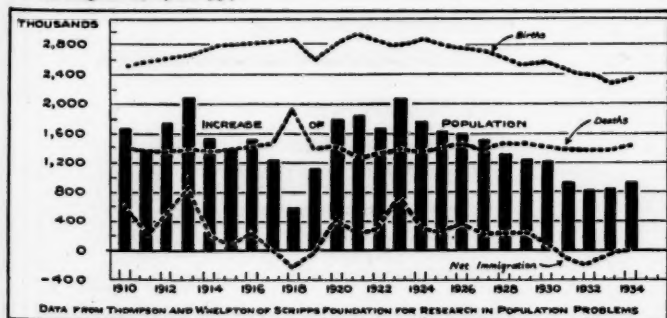
<sup>1</sup> Standardized for age. For data upon which the above chart is based, see: Sydenstricker, E. and Notestein, F. W.: Differential Fertility According to Social Class. *Journal of the American Statistical Association*, March, 1930, pp. 9-32. Tabulations from the 1900 Census returns and recent data from various private sources show essentially similar results.



<sup>1</sup> About 370 children under five years of age per 1,000 women fifteen to forty-four years of age, inclusive, are required to maintain population stationary at the 1930 expectation of life in the United States. In 1930 the seven cities largely of American stock, represented in the top bar, lacked, therefore, nearly 40 per cent of having enough children to maintain their population permanently stationary without accessions from outside, and all cities of over 100,000 population had a deficit of over 20 per cent, while the smaller cities had a deficit of about 8 per cent. On the other hand, the rural non-farm (mostly village and suburban) population had a surplus of 27 per cent, and the farm population a surplus of nearly 50 per cent. In 1930 urban deficit and rural surplus about balanced. Since 1930 there has been a further decline in births of more than 10 per cent in the nation as a whole.

Fig. 3. Number of children under five years of age per 1,000 women of child-bearing age in urban and rural populations of the United States, 1930.<sup>1</sup>

Fig. 4. The annual increase of population of the United States, births, and net immigration, 1910-1934.<sup>1</sup>



<sup>1</sup> Fifteen years ago the population of the United States was increasing about 1,800,000 a year. Now the increase is only 800,000. A stationary population is approaching rapidly, but it appears to be ten years off or longer. The number of births has been trending downward since 1921. There is now about 11 per cent fewer children under ten years of age than when the census was taken six years ago. The number of deaths remains almost stationary but must increase soon, because of the rapid increase in old people. There was 34 per cent more people over sixty-five years of age in the nation in 1930 than in 1920, and another increase of one-third is inevitable between 1930 and 1940.

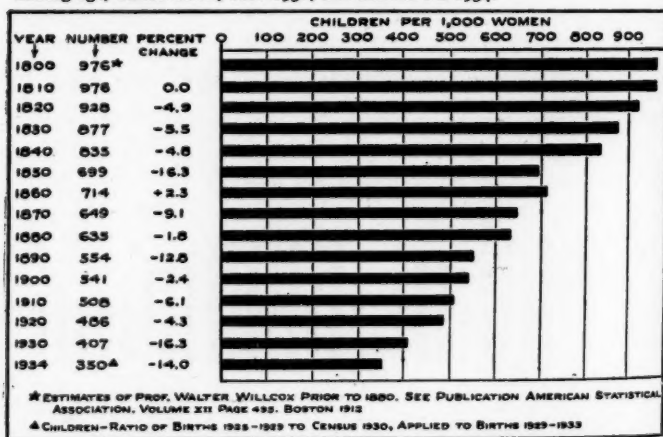
For these and other reasons I expect the decline in births, unless there is a great change in the ideals of the people, particularly of the city people, will persist for at least several decades.

#### SOME IMPLICATIONS OF THE DECLINE IN BIRTHS

This brings us to the second question—what effects will the decline in births and later in population, have upon agriculture?

First let us consider a development about which there can be no difference of opinion—a decline in births involves first a decline in number of children, later a decline in youth and the middle-aged, and, finally, a decline in old people, provided immigration from abroad is immaterial. Today we are in the first stage of the process, which is characterized by a decline in children and an increase in middle-aged and old people. There is about 11 per cent fewer children under 10 years of age than there was six and one-half

Fig. 5. Number of children under five years of age per 1,000 women of child-bearing age, United States, 1800-1930, and estimate for 1934.<sup>1</sup>



<sup>1</sup> The birth rate, as measured by the ratio of children under five to women sixteen to forty-four years of age, inclusive, has been decreasing in the United States for more than a century. But from 1920 to 1930 the decline was over twice as rapid as in previous decades, except those ending in 1850, 1870, and 1890, when, it is evident, there was an abnormal underenumeration of young children. And from 1930 to 1934 the decline was almost as great as in any previous decade. The significant fact shown by the graph is that the declining birth rate is a long-time trend, and that the rate of decline has become more rapid in recent years.

years ago, when the census was taken; and about 17 per cent more people over 65 years of age. Inevitably there will be twice as many old people in the nation twenty-five to thirty years hence as at present, and nearly three times as many fifty years hence. They are living now and the number reaching these ages can be estimated within probably 5 per cent of error by using life tables. But during the next fifteen years there will be a great increase in number of families in the nation, as the children born during the crest in the wave of births from 1921 to 1924 reach the age to marry. Millions of additional houses will be needed during the next decade or two.

But the decline in children is probably affecting already the demand for certain agricultural products. Four urban studies indicate that children consume 50 to 100 per cent more milk per capita than adults.<sup>3</sup> If this be the case, the consumption of milk is already being affected by the change in age composition of the population. On the other hand, if adults consume more cereals and meat than children, as appears probable, the demand for these foods may continue to increase after the population of the nation begins to decline. But, speaking broadly, a decline in population will soon be followed, very likely, by a decline in consumption of farm products—for consumption per capita of the foods and fibres, in the aggregate, has not varied more than a few per cent for a third of a century at least, and the trend, if not horizontal, is slightly downward. (See Figure 6.)

A second consequence of a declining national population, provided the difference between urban and rural birth rates persists, will be a more rapid decline in urban than in rural population, un-

<sup>3</sup> Howe, Charles B. and Warren, Waite C.: *The Consumption of Dairy Products in Seven Metropolitan Cities of New Jersey*. New Brunswick, New Jersey, October, 1932, pp. 68-84.

Cowden, T. K. and Sturges, Alexander: *The Consumption of Fluid Milk and other Dairy Products in Philadelphia, Pennsylvania*, June, 1934. Preliminary Report, Pennsylvania Agricultural Experiment Station, July, 1934, Technical Paper No. 659, pp. 19-20, 28-31.

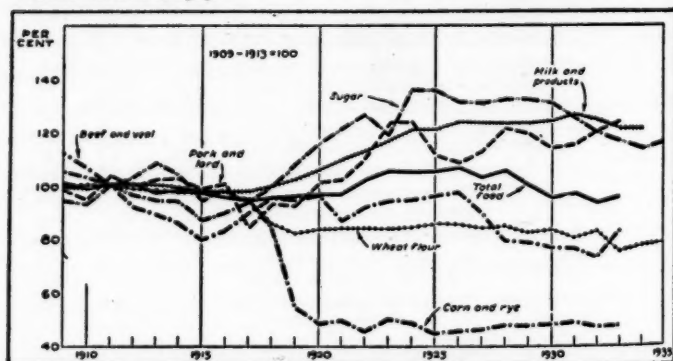
Waugh, Frederick V.: *The Consumption of Milk and Dairy Products in Metropolitan Boston in December, 1930*. United States Bureau of Agricultural Economics, and Others, September, 1931, pp. 22-23.



less migration from rural to urban areas is accelerated. The great uncertainty in the population prospect is not the total number of people in the nation, but their residence—whether increasingly rural or urban.

Now it is obvious that if the number of people associated with agriculture increases while the number not so associated soon becomes stationary and later declines, and per capita consumption remains stationary, a less commercial agriculture is inevitable, provided exports of farm products do not increase greatly. The outlook for any great increase in exports, except of cotton, tobacco, and fruit, is not bright. The population of most European countries which formerly received most of our exports of food-stuffs is almost stationary, and probably will soon decline. Meanwhile, the governments of these countries must protect the farmers, for they provide not only the food needed by the urban people, but also more than their share of the soldiers in war and citizens in peace.

Fig. 6. Changes in consumption of specified food products per person in the United States since 1909.<sup>1</sup>

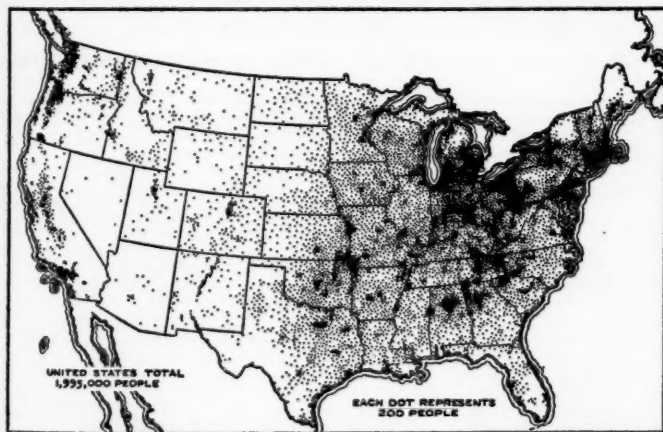


<sup>1</sup> The need for farm land may be greatly affected by the diet of the people. Notable changes occurred during and after the World War. The per capita consumption of corn for human food apparently dropped one-half between 1911 and 1920, and of wheat about one-sixth, mostly between 1917 and 1918; while the per capita consumption of sugar increased a third between 1918 and 1924, and of pork and lard about a fourth between 1919 and 1923. The curve for beef and veal shows a cycle seventeen years in length, with a slightly downward trend, but the per capita consumption of milk and dairy products has been well maintained. Combining all the foods, it appears that there has been a slight downward trend since 1928. The meat and milk estimates are preliminary and subject to correction.



We had a foretaste of the consequences of an increasing farm population during the depression. In January, 1935, when the Agricultural Census was taken there were enumerated 2,000,000 survivors of the "back-to-the-land" movement—people living on farms who were not living on farms five years before. (See Figure 7.) And about 2,000,000 more people, mostly farm youth, were backed up on farms, who, under predepression conditions, would have migrated to the cities. Five hundred thousand new farms were established between 1930 and 1935 according to the census, and most of these farms were located in areas of poor soils and cheap land, also generally of high birth rates, notably in the Southern Appalachians. (See Figure 8.) Probably half of these farms might be designated as "submarginal." In several counties of eastern Kentucky the increase

Fig. 7. Geographic distribution of people living on farms January 1, 1935, who were not living on farms five years before (children under five excluded).<sup>1</sup>

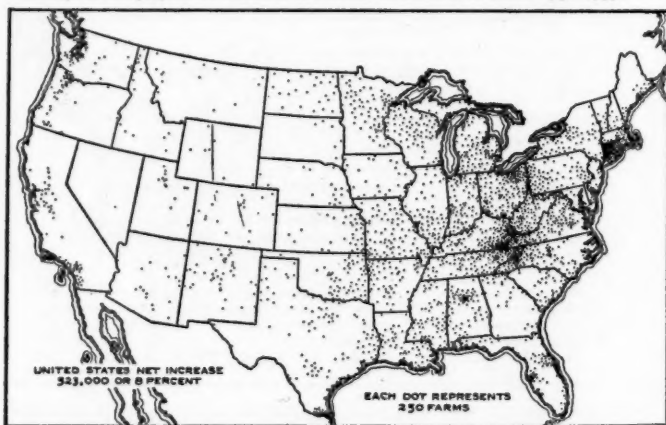


<sup>1</sup> The location of the people living on farms in 1935 who were not living on farms five years before is similar to that of the increase in number of farms (Figure 8). But the density of this "back-to-the-land" population is greater in the manufacturing belt of western Pennsylvania, eastern Ohio, and southern Michigan, also around Philadelphia, on the Piedmont of the Carolinas and Georgia, around many cities in the central West and Southwest, and in the Pacific Coast States. It is significant that the number of these people who were not living on farms five years before exceeded the increase in the farm population in most of the Corn Belt and of the Great Plains region, also in New York, in all of the Cotton Belt states, except Arkansas, and in the Pacific Coast states. Apparently the migration from farms in these states during the depression exceeded the natural increase in the farm population.

in number of farms exceeded 50 per cent in the five years and from one-third to two-thirds of all the families in the counties were on relief in 1934. A large increase in farms occurred also around most cities, particularly the industrial cities.

I anticipate that a rapidly declining national population will be accompanied by many of the characteristics of an economic depression, including population pressure on the poorer lands. The commercial demand for most foodstuffs will decline, unemployment may increase, particularly of those past the prime of life; while the diminishing number of children and youth and increasing number of aged may induce a pessimistic attitude toward the future on the part of many people. The farmers of the United States during the next fifty years must make, in all likelihood, many adjustments in agricultural methods and manner of life, as a consequence of the low and persistently declining birth rate in

Fig. 8. Geographic distribution of increase in number of farms 1930-1935.<sup>1</sup>



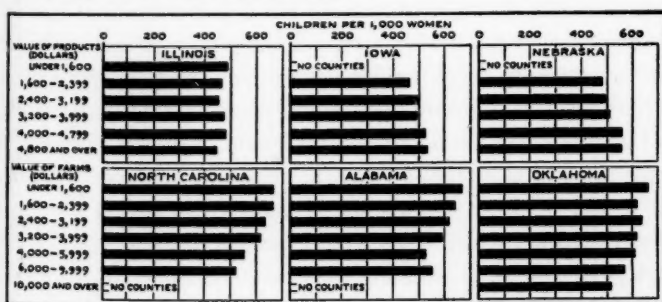
<sup>1</sup> This map indicates clearly that the increase in farms between 1930 and 1935 was relatively greatest, in general, in areas of poor soils or hilly surface. The Southern Appalachians, the cut-over lands of the upper Great Lakes region, the eroded Indian reservation lands of the Southwest, the stony cut-over lands of western Washington and northwestern Montana, are all areas of cheap land and more or less self-sufficing or part-time farming. By contrast, the percentage increases were small in areas of commercial agriculture such as the prairie portion of the Corn Belt, the wheat regions, and the Cotton Belt. In many counties of these areas a decrease occurred.

the cities. But, after all, the farmers' problems are no more difficult, perhaps not as difficult, as those that will face the people living in cities.

A third major consequence of a declining population relates to distribution of wealth. Since the decline in birth rates in the cities and in the farm population of the South, at least (Figures 3 and 9), is more rapid in the middle and upper classes than in the lower, measured by wealth, the tendency will be toward increasing concentration of wealth. Moreover, when parents have only one or two children, it is obvious that through inheritance wealth tends to concentrate. When such children marry, the wealth of two families may be concentrated into one family. This is, in my opinion, one of the major factors accounting for the concentration of wealth in the United States.

Fourthly, our economic system penalizes parenthood on the farms as well as in the cities, though perhaps in lesser degree. The farm youth not needed in agriculture, because of the progress in

Fig. 9. Number of children under five years of age per 1,000 women of child-bearing age in 1930 in rural-farm populations of specified areas according to value of farm products or value of farms in 1929.<sup>1</sup>



<sup>1</sup> In the cities the birth rate, as measured by the number of children under five to women fifteen to forty-four years of age, inclusive, decreases rapidly with rise in economic and social status, except that a few families who have inherited wealth, and whose young people need not, therefore, economize in number of children, apparently have almost as many children as the poor. The general decrease in number of children with increase in wealth is, it would seem, true of the farm population in the Southern states also; but in at least two of the Corn Belt states there is an increase in the size of the family with increase in income. Like the established families of wealth in the cities, the families on the best farms of the Corn Belt seem likely to produce far more than their proportion of the nation's leaders in the future.

technique as well as the high birth rate, have migrated to the cities. About half the farm youth migrated during the decade 1920-1930, some 6,300,000 net. These youths not only were born, but also fed, clothed, and educated mostly at the expense of the farm people. If merely \$150 a year be allowed as the average cost of raising a child on the farms of the nation, and assuming that at fifteen years of age he or she is self-supporting or leaves the farm, it appears that the farming people contributed during that decade some \$14,000,000,000 in the youth supplied to the cities. Nor is this all—when the farmer and his wife die the estate is divided among the children. About one-sixth of the farmers died during that decade, and, apparently, some \$4,000,000,000 or \$5,000,000,000 was transferred to the cities as a result of the settlement of farm estates. In addition, the Bureau of Agricultural Economics estimates that some \$8,000,000,000 was paid to nonfarm people as interest on farm mortgage debt, and some \$10,000,000,000 as rent to nonfarm persons owning farm land. Much of both of these payments was doubtless the result of prior migration from farms. These items total about \$36,000,000,000, which is nearly one-third of the gross value of farm products during that decade. But if this migration had not occurred there would have been a notable increase in number of workers on farms and a notable decrease in production per worker—doubtless also in standard of living among the farming people.

The immediate economic interest among farming people is to reduce their birth rate. But if there be no surplus farm youth migrating to the cities, the population of many cities after a few years would decline rapidly. This would mean a declining market for farm products. Thus a spiral of cause and effect phenomena would be engendered, with a rapidly descending trend. The farmers of the nation face a dilemma as a result of urban people failing to reproduce the race.

Time does not permit the consideration of other implications in the population prospect of significance to agriculture. But I should

note before concluding that these consequences of a declining birth rate will develop slowly and silently—they will come not like a thief in the night, but rather like the progress of the seasons. There will be warm days and then cool days, as in autumn. Periods of economic prosperity and then of depression are likely to recur. During the periods of prosperity farm youth doubtless will migrate in large numbers to the cities, full of hope and strength and courage. Many of these youth will later inherit farms, which they will sell on mortgage or rent to tenants. Then during periods of depression others, less fortunate, will return to farms seeking shelter and sustenance with relatives and friends—older, broken in hope, and sometimes in health. Wealth will be transferred to the cities and poverty to the rural areas.

#### IN CONCLUSION

These developments can be retarded—but that they will be is uncertain—by the rapid decentralization of population, which will probably involve much decentralization of industry and commerce, by the spread of part-time farming, and by a revolution in the thought of the middle and upper classes relative to their responsibility for the reproduction of the race and the preservation of the family. In the farm population this revolution, it is hoped, will be reflected in a great increase in number of farms transmitted from generation to generation by inheritance.

However, the ultimate solution of this problem, which is none other than the preservation of civilization, will be found, in my opinion, in the gradual replacement of the spirit of selfishness, so prevalent in our present capitalistic system, and which is now having unexpected effects on the birth rate, by the spirit of sacrifice, so characteristic of the rural family. The great need, it seems to me, is loyalty to an ideal. There are many worthy ideals—loyalty to the state, loyalty to science, loyalty to the church—but I wish to submit to you as the most fundamental of these ideals, loyalty to the family.

This conclusion may seem to some of you utterly idealistic. May I call your attention to the power of ideals in revolutionary philosophies throughout history and to the strength that resides in the spirit of sacrifice. If our liberalistic, more or less democratic, economic and social system is to survive, it, too, must stimulate the spirit of sacrifice; or else find a way to reduce the penalties on parenthood.

# RHEUMATIC HEART DISEASE AMONG AMERICAN INDIAN SCHOOL CHILDREN IN DIFFERENT CLIMATES<sup>1</sup>

by JOHN R. PAUL, M. D.<sup>2</sup>

THE relationship of the prevalence of human disease to a given environment is a subject much discussed of late, but difficult to define. High lights of such a relationship are of course obvious. Tropical diseases are found in the tropics more frequently than elsewhere. Diseases which are spread by crowding within doors are generally more prevalent in cities during the winter, than among rural populations during the summer. But the whole subject is still so complex and the number and types of factors involved are so ill-defined, that one cannot generalize about environmental aspects of disease with much safety. On the other hand, any careful measurement dealing with this subject may well deserve attention, particularly if it concerns a disease with a somewhat obscure method of spread, and so it has been with this object in view that the following work has been planned. The disease selected, namely rheumatic heart disease, fulfills the requirements because it is one which is common and of somewhat obscure pathogenesis. It further lends itself to this type of study because there is considerable evidence that its prevalence is influenced by climatic conditions. Accurate measurements of its geographical or climatological distribution are, however, few in number and so it has been the major object of this work to make such measurements under controlled conditions.

Among these controlled conditions, the choice of one or more populations suitable for such a survey has seemed to be important. One of the reasons that American Indian children are satisfactory in this respect is that, irrespective of their geographical locality,

<sup>1</sup> The expenses of this work have been defrayed by the Milbank Memorial Fund.

<sup>2</sup> From The Desert Sanatorium, Tucson, Arizona.



certain Indian tribes are apt to be somewhat more homogeneous from a racial standpoint than are most American populations. Another reason is that living (*i. e.* housing) conditions do not vary much on many of the different Indian Reservations. And a third is that within certain Reservations many of the adults, and almost all of the younger children have spent their lives within a few miles of the place of their birth. Their illnesses, therefore, should be truly representative of local living and climatic conditions. For at least three reasons, therefore, several such groups of Indians may furnish more valuable information about the geography of disease than do most school populations of this country.

The actual method of measuring the prevalence of rheumatic heart disease used in this survey has consisted in determining the various rates with which this condition could be found among the Indian school children living in certain widely separated locations. In the performance of the examinations necessary for the determination of these rates, a section of the West was first outlined and certain of the more suitable Indian Reservations within this section were tentatively chosen. Permission was then obtained from the United States Office of Indian Affairs, Department of the Interior, for proceeding with the work.<sup>3</sup> Eventually from this section, three groups or divisions of Indian Reservations were selected; a northern one in Wyoming and Montana; a middle one in northern New Mexico and Arizona, and a southern one in southern Arizona. Although widely separated from a geographical and climatological standpoint these three different groups were fairly similar in other respects, in that they were composed of children who were either full-blooded American Indians, or at least possessed of a certain amount of Indian blood. The northern groups consisted of Shoshone, Arapahoe, and Crow Indians, of which about 40 per cent

<sup>3</sup> I am primarily indebted to Dr. J. G. Townsend, Director of Health, Office of Indian Affairs, Washington, D. C., for this privilege, and I am also indebted to many medical officers in the Indian Service, whose names are too numerous to mention here, but whose generous cooperation and support have made this work possible.



were listed as being of full-blood. The middle group consisted almost entirely of full-blooded Navajo Indians, and the southern groups of full-blooded Pima and Papago Indians. It was our object to examine about 1,000 children of approximately the same age from each of the three (northern, middle, and southern) divisions. All of the physical examinations were made by the author and one assistant so that the same diagnostic criteria could be used in the different localities.

Results obtained from this study appear in Table 1. To evaluate them, they should be first compared with those obtained from white school children from other sections of this and other countries. Unfortunately, however, there are few comparable surveys in which the same diagnostic criteria and the same methods have been used. Nevertheless one comparable rate has been determined in and about the City of New Haven, Connecticut, (latitude about 41° north) where the rheumatic heart disease rate among 2,624 urban and rural school children was found to be 2.2 per cent.<sup>4</sup> The Indian rates which appear in Table 1 have been derived from rural populations alone and are probably influenced by a number of factors which will be discussed in a subsequent and more extensive report of this work.<sup>5</sup> Regardless of these factors, however, the rate found in the north shows that a high prevalence of rheumatic fever and its most serious manifestation, rheumatic heart disease, exists among some tribes of Indians who live in the cold, though relatively dry, climate of Montana and Wyoming. This is of some interest because the element of cold coupled with dampness (as opposed to dryness) has long been incriminated as one of the primary conditions responsible for a high prevalence of rheumatic fever; furthermore the influence of city life (as opposed to country life) has also

<sup>4</sup> The work in New Haven was also supported by the Milbank Memorial Fund, viz: Paul, J. R.; Harrison, E. R.; Salinger, R.; and De Forest, G. K.: *The Social Incidence of Rheumatic Heart Disease. American Journal of Medical Sciences*, September, 1934, clxxxviii, No. 3, p. 301.

<sup>5</sup> Paul, J. R. and Dixon, G. L.: *Climate and Rheumatic Heart Disease Among Indian School Children* (to be published).

LOCATION OF RESERVATIONS	LATITUDE NORTH	CLIMATIC CONDITIONS		NUMBER OF INDIAN CHILDREN EXAMINED	NUMBER WITH DEFINITE RHEUMATIC HEART DISEASE	PER CENT WITH RHEUMATIC HEART DISEASE
		Temperature <sup>1</sup>	Precipitation <sup>2</sup>			
North	44°-46°	42.5°	10-15	688	31	4.5
Middle	36°-37°	47.5°	7-10	1,106	21	1.9
South	31°-33°	67.5°	3-10	1,019	5	0.5

<sup>1</sup>Approximate average normal temperature for the year in degrees F.

<sup>2</sup>Normal annual precipitation in inches.

Table 1. Rheumatic heart disease rates in three different locations.

been incriminated as an important predisposing condition. Consequently, it has been remarkable to find a higher prevalence in relatively dry Montana and Wyoming (normal annual precipitation ten to fifteen inches) among rural Indian children, than that found in the vicinity of New York City (normal annual precipitation forty-five inches) among urban children. This suggests that either a high susceptibility exists for the disease on the part of at least some Indians, or that something may be present in their living conditions particularly conducive to the spread of disease.

It is also evident from Table 1 that a striking drop in the rheumatic heart disease rate occurs among the groups of Indians examined as one proceeds from the Canadian to the Mexican border. Some of the factors or variables which may influence this finding will be discussed in a future report.<sup>3</sup> But regardless of the nature of these variables the difference in prevalence in these different regions is sufficiently marked to demonstrate quite clearly that at least some populations of Indian children are a favorable group from which much may be learned about the geography of rheumatic heart disease.

## SCHOOL HEALTH INSPECTION BY TEACHERS

*by* DON W. GUDAKUNST, M. D.<sup>1</sup>

THE purpose of medical examinations in school should be to discover children in need of additional advice and guidance so as to improve or preserve their health. It, ordinarily, is impossible, if not actually inadvisable, to attempt to examine all children each school year. Whenever such a program is undertaken, the examination by medical men becomes either farcical because of its superficiality, or has other by-products of a nature too undesirable to warrant its continuation.

Various screens and arbitrary means of selecting different groups of children have been devised. The most commonly applied selection is one based upon the examination of all children in certain grades, usually those entering school, fifth or sixth grade, and again on entering high school. While this reduces the number of children served by the school physician, it leaves much to be desired. There are many children in need of medical attention who are ignored entirely and there are many brought to the attention of the doctor who are already adequately cared for, or who are in no need of medical attention. Such a plan obviously leaves much to be desired from the point of intelligently directing the limited services and tends to create a further sense of dependency on the part of the parents, causing them to rely on the scheduled medical examination in school in place of turning to their own medical counsellor for guidance.

In an attempt to overcome some of these faults, the School Health Service of the Detroit Department of Health in 1921 introduced what they were pleased to term a "Teacher Health Inspection" program. By this somewhat ambiguous title was meant a

<sup>1</sup> Director of School Health Service and Deputy Commissioner, Department of Health, City of Detroit, Michigan.

service whereby the teachers, after instruction and training, were entrusted with the selection of those children who were most in need of medical attention. In a few selected schools the teachers were shown how to inspect the children in the class rooms for defects or indication of defects in respect to those points that could be inspected visually or with simple aids. In addition to examining the children for faults of vision and hearing, they were asked to evaluate the health condition of the skin, teeth, tonsils, palate, cervical glands, thyroid, and to look for evidences of nasal obstruction as shown by chronic mouth breathing, and to pass judgment on the nutritional state and orthopedic system.

It is not the purpose of this paper to give in detail the methods of training teachers to conduct this type of inspection. Suffice it to say that the average school teacher gladly added this task to her program after a few hours of lecture and demonstration, aided by printed instructions. It is to be emphasized, however, that without such instruction, and without guidance and supervision of a conscientious nature, such work would almost be doomed to failure. The teachers find the work interesting and profitable. This is well demonstrated by the fact that the plan spread on a purely voluntary basis from the few schools included during the early years to all of the public and most of the parochial schools of the City. The rapidity of spread depended solely on the rate at which adequate instruction could be supplied to the teachers wishing to take part. At no time was any school or any teacher asked to participate; yet in a few years it was an almost universal practice.

A preliminary study of the efficacy and accuracy of the work of the teachers was made and reported on by Buck.<sup>2</sup> The study was made, however, at a time when the plan was as yet new, and while there was continuous supervision of the comparatively few teachers engaged in the work. In order to further check the accuracy

<sup>2</sup> Buck, C. E.: School Health Examinations. *American Journal of Public Health*, November, 1925, xv, No. 11, p. 972.

of the teachers' inspections, as measured by subsequent medical examinations, detailed records were kept as to the defects of each individual child inspected by the teacher and referred to the physician. The records of the year 1930 have been selected for more complete analysis. This year has been chosen as it represents the last year during which this somewhat elaborate system of bookkeeping was in use. It is to be pointed out that such record-keeping can in no way serve the individual child, or in any way alter the health practices of that child. It is of value only insofar as it serves to furnish information to be used to measure the program itself.

The records from 159 public and parochial schools were included in this report. The enrollment of these schools was 147,043. There were 28,551 children in the group on whom we had complete information relative to all the findings by the school teacher and a school physician. This number of schools and students does not represent a selection, but includes all the schools and all the students in these schools in which a complete inspection and a complete examination were made by both teacher and physician. There were additional schools in which the service was rendered by the teacher but where no subsequent medical check was made by physicians; likewise, there were certain schools where the preliminary screening inspection had not been carried out by the teacher, but where certain arbitrary grades were examined by physicians. This seeming irregularity was due to a deliberate attempt to set up a control practice for the purpose of studying certain other phases of the medical examination. It should be added at this point that while this work was carried out in the schools during 1930 and previously, due to the depression it was not possible to secure adequate clerical service to analyze the data until help from a WPA project was secured.

Under the plan of teacher health inspection all children included in Table 1 were completely inspected for the points included. Those who were found as the result of this inspection to have what the teacher thought to be some condition calling for medical attention

ITEM	TOTAL DISAGREEMENTS		OVERESTIMATED BY TEACHERS		UNDERESTIMATED BY TEACHERS	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
<b>TOTAL</b>	25,782	8.2	15,807	5.0	9,975	3.2
Skin	527	1.8	234	0.8	293	1.0
Anemia	503	1.8	428	1.5	75	0.3
Thyroid	1,053	3.7	577	2.0	476	1.7
Tonsils	7,839	27.5	5,649	19.8	2,190	7.7
Mouth Breathing	1,132	4.0	830	2.9	302	1.1
Teeth	9,404	32.9	3,641	12.8	5,763	20.2
Palate	66	0.2	65	0.2	1	—
Cervical Glands	1,519	5.3	1,195	4.2	324	1.1
Orthopedic	138	0.5	22	0.1	116	0.4
Vision	2,916	10.2	2,508	8.8	408	1.4
Hearing	685	2.4	658	2.3	27	0.1

Table 1. Analysis of 28,551 inspections and reexaminations.

were referred to the school physician who in turn made a complete examination of all the same items included in the schedule, with the addition of a heart examination. This type of dual coverage allowed for an analysis as to the number and percentage of items wherein there was an essential disagreement between the teacher and physician. A disagreement for the purpose of this study was interpreted to mean a difference as to whether the condition deviated from normal sufficiently to warrant referral to a private physician for corrective work or further study and treatment. The scale used in marking each item was:

0-normal

1-slight deviation from normal—not needing medical attention

2-appreciable deviation—calling for medical follow-up

3-marked deviation—calling for immediate follow-up

A difference in markings between 0 and 1, or 2 and 3, on the part of the teachers and physicians was not considered a "disagreement." However, if one used either 0 or 1 and the other judged the condition as 2 or 3, there was considered to exist an essential dis-

agreement. No consideration was taken of the fact that the physician might himself be wrong in his opinion. For the purpose of this study his opinion was taken as a basis of comparison, since we were measuring not the medical condition of the child, but rather the degree of agreement between the findings of a school teacher and a school physician. Nor was any consideration given to the fact that in the weeks or even months that elapsed between the two services the essential condition of the child might be subject to change. Faults discovered by the teacher might have been corrected or disappeared, or new pathological conditions might have developed. The statistical problems introduced by the time factor were too great to be considered in view of the fact that the apparent differences of opinion were so comparatively small.

Children considered by the teachers as not presenting physical defects of great enough severity were not referred to the school physicians for examination. It was not the purpose of this study to determine the number of children that might be missed who were in need of medical examination; but rather it was hoped to be able to measure the efficiency of the work done by the teachers in measuring and evaluating particular items. This, however, leads to certain possible conclusions as to the efficacy of the screening method in selecting children in need of medical follow-up. This is particularly so since each set of examiners made a complete tabulation of their findings, both positive and negative.

It is to be noted from the table that the greatest gross error occurred in the examination for teeth. While this inspection should be highly objective in nature, the question of judgment entered in interpreting the significance of the findings. This inspection was not for the purpose of determining whether there was or was not evidence of dental caries, or poor oral hygiene—but rather for the purpose of determining whether there was present any condition immediately inimicable to the child's health that warranted reference to corrective agencies and a follow-up by the school staff.



The picture is further distorted by the fact that at this time there was an independent dental inspection made of these same children by a staff dentist. Separate records were kept—different staffs were involved—and the director of school health service exercised only nominal supervision over the dental health program. It is to be assumed that under these conditions a different attitude and a different degree of care might well have been adopted by both teacher and physician than if the full responsibility had been placed on them for dental health. The school physicians seemed to have been much more concerned with the need for dental care of the children examined than were the teachers since an additional 20.12 per cent of all the children inspected by the physicians were marked as in need of dental care.

The comparatively high disagreement between physicians and teachers in respect to the condition of the tonsils was to be expected. As shown by the American Child Health Association and other groups of workers, there is a similarly high percentage of disagreement existing between physicians themselves when the judgment is based on a physical inspection alone. Here the important point is that of the 25,782 children examined only 7.7 per cent were thought by the doctors to be in need of medical care, and who had been passed by the teachers as being in no such need. It is therefore quite fair to conclude that within the limits of accuracy of the type of examination made by doctors in school, comparatively few children would be overlooked by the teacher in passing judgment on the tonsil health of her children.

The high degree of agreement between teacher and physician in respect to faults of vision and hearing is to be expected from the comparatively highly objective type of examinations conducted, and from the fact that rather high degrees of error had to be present before the condition was labeled as a defect. In respect to vision slight errors of 20/30 or less were not referred by the teacher to the physician unless such errors were accompanied by severe symptoms

or evidence of not being able to do satisfactory school work. Furthermore, for a number of years particular attention has been paid by all teachers and school health workers in detecting vision errors in the entire enrollment. Comparatively few new cases were discovered in any one year, excepting in the newly entering group.

On the basis of these findings Detroit has entirely discontinued the practice of examining any arbitrary age or grade groups. Since the examination by the physician revealed a total of but 3.2 per cent of conditions that had not been discovered by the teachers themselves, it seemed just to discontinue the work of the doctors in schools as a fact-finding device. The teachers themselves, with the amount of instruction and supervision afforded, were able to unearth the facts in an adequate manner. Teachers did not examine for abnormalities of heart and therefore children, passed through this screen, might go on with an undetected heart pathology. This objection was shown by another study to be to a very large extent purely theoretical and did not exist in actual practice to a degree sufficient to constitute a real objection. Those children who had diseased conditions of the heart were also those who had other faults, or, if the condition was at all serious, it was known to the parents, school, and medical staff. It is doubted if any number of impairing cardiac conditions were missed. During the transition stage from the examination of selected grades to the universal use of the teacher inspection plan there was opportunity to compare the percentage of cardiac defects of these same grades in the two groups receiving the different types of service. The percentages of cardiac defects recorded for the first and fifth grades were the same when all children of those grades were examined annually by a physician as when the physician examined only those referred by the teacher on the basis of a defect discovered by her.

The teachers are well able to carry out the fact-finding work, discovering those children in need of medical care. A serious question may be raised as to whether the teacher is prepared to take

the responsibility for transmitting this information to the parents in a manner that will lead to placing these same children under medical care. Therefore the children are referred to the school physician, but only for the purpose of having him demonstrate to the child's parent the need of medical care. The parents of those children found by the teacher to have defects are invited to the school. The physician then demonstrates to the parent the need of medical attention. He further is charged with the task of pointing out to the parent the method of securing the indicated attention in a manner compatible with the parent's social and economic status.

When there has been such a contact in the school between the parent and the physician, there is little that the nurse needs to do in immediate follow-up. The physician has accomplished all that the nurse can do in a first home visit.

A further screen is applied in selecting those children who are referred to the school physician. If the teacher discovers a defect in a child and it is a recorded fact that this is known to the parent, and that the child is securing medical care, then this child is not referred to the school doctor. The facts are known. The parents are handling the situation to the best of their ability and there is nothing more the school physician can add. Any examination or evaluation on his part would be equivalent to passing judgment, not on the child's health, but rather on the quality of care administered by the attending physician. Such a course of action can only place insurmountable obstacles in the path of the program.

Still a further limitation of the number of children referred to the school physician has been developed. If a child can be given an examination by his own physician, and if the findings of that physician can be transmitted to the school, then there is nothing to be gained by having either the teacher or the school physician inspect or examine this child for the presence of physical defects. An examination blank has been developed and used in Detroit for the past several years. It has been used to an increasingly large extent so

Name \_\_\_\_\_  
Address \_\_\_\_\_  
School \_\_\_\_\_  
I have \_\_\_\_\_  
an/any \_\_\_\_\_  
Code: O \_\_\_\_\_  
OO \_\_\_\_\_

Height \_\_\_\_\_  
Weight \_\_\_\_\_  
Skin \_\_\_\_\_  
Nutrition \_\_\_\_\_  
Endocrine \_\_\_\_\_  
Tonsils \_\_\_\_\_  
Diphtheria \_\_\_\_\_  
Smallpox \_\_\_\_\_

Date of \_\_\_\_\_  
Mumps \_\_\_\_\_  
Remarks \_\_\_\_\_

The \_\_\_\_\_  
allow \_\_\_\_\_  
schools \_\_\_\_\_  
case, \_\_\_\_\_  
blind \_\_\_\_\_  
retarded \_\_\_\_\_

If \_\_\_\_\_  
classes \_\_\_\_\_  
can be \_\_\_\_\_

St \_\_\_\_\_  
stitute \_\_\_\_\_  
request \_\_\_\_\_  
be for \_\_\_\_\_

I \_\_\_\_\_  
school \_\_\_\_\_

fin

# PHYSICAL EXAMINATION BY PRIVATE PHYSICIAN

Name \_\_\_\_\_ Age \_\_\_\_\_ Color \_\_\_\_\_  
 Address \_\_\_\_\_ Grade \_\_\_\_\_  
 School \_\_\_\_\_ New Entrant \_\_\_\_\_ Yes \_\_\_\_\_ No \_\_\_\_\_

I have examined this child and advised the parents as to the best procedure to follow to safeguard and improve health. The following are the important findings:  
 Codes: 0 - no defects; 1 - slight defects; 2 - 3 - 4 - grading denotes seriousness of the defect;  
 00 - condition has been corrected; 1 - now treating.

Height \_\_\_\_\_ Nose \_\_\_\_\_ Orthopedic \_\_\_\_\_  
 Weight \_\_\_\_\_ Teeth \_\_\_\_\_ Vision: R - 20/\_\_\_\_ L - 20/\_\_\_\_  
 Skin \_\_\_\_\_ Palate \_\_\_\_\_ Eyes \_\_\_\_\_  
 Nutrition \_\_\_\_\_ Cervical Glands \_\_\_\_\_ Hearing: R - 20/\_\_\_\_ L - 20/\_\_\_\_  
 Endocrine Glands \_\_\_\_\_ Cardiac \_\_\_\_\_ Ears \_\_\_\_\_  
 Tonsils \_\_\_\_\_ Lungs \_\_\_\_\_

Diphtheria Prevention \_\_\_\_\_ Negative Schick Test \_\_\_\_\_  
 Mo. \_\_\_\_\_ Date \_\_\_\_\_ Yr. \_\_\_\_\_ Mo. \_\_\_\_\_ Date \_\_\_\_\_ Yr. \_\_\_\_\_  
 Smallpox Vaccination \_\_\_\_\_ Dick Test \_\_\_\_\_ Pos. \_\_\_\_\_ Neg. \_\_\_\_\_  
 Mo. \_\_\_\_\_ Date \_\_\_\_\_ Yr. \_\_\_\_\_ Mo. \_\_\_\_\_ Date \_\_\_\_\_ Yr. \_\_\_\_\_

Date of Communicable Diseases: Chickenpox \_\_\_\_\_ Diphtheria \_\_\_\_\_ Measles \_\_\_\_\_  
 Mumps \_\_\_\_\_ Scarlet Fever \_\_\_\_\_ Whooping Cough \_\_\_\_\_ Others \_\_\_\_\_

Remarks and Recommendations: \_\_\_\_\_

The Board of Education maintains classes for the handicapped in elementary schools so as to allow every child to receive the greatest good from the schools. These classes are: Open Air schools, and Open Window rooms for the tuberculosis exposure case, the arrested tuberculosis case, and the severely malnourished; crippled schools; sight-saving classes; schools for the blind; lip-reading classes and schools for the deaf; cardiac classes; and classes for mentally retarded.

If the child is handicapped in any manner where special educational work in one of these classes would be desirable, please indicate which. Transportation by the Board of Education can be furnished for certain of these cases.

Since the placement, classification, and management of these cases, while in school, constitutes a serious problem, it is frequently necessary for the child, for whom the physician requests admission, to be re-examined by the school physician. This school examination will not be for the purpose of prescribing treatment, but solely to meet administrative needs.

I suggest that this child be considered as an applicant for a \_\_\_\_\_ school or class.

M.D. Address \_\_\_\_\_ Date Examined \_\_\_\_\_  
 Mo. Date Yr.

PLEASE RETURN THIS TO THE SCHOOL NURSE

(over)

Fig. 1. Examination blank used by private physicians of Detroit, Michigan, for transmitting findings of physical examinations of school children to the school authorities.

In order to enjoy life to the fullest, and to obtain the most from work or play, every person should be in the best possible health. Many of the handicaps of adult life have their start in youth. In order to assure a successful future for your child you are urged to take him to your own physician for a complete health examination each year. Be guided by the physician's advice. Give your child the advantages of the modern type of preventive medicine being practiced by the physician of today. HAVE YOUR PHYSICIAN FILL OUT THE BLANK ON THE REVERSE SIDE AND RETURN IT TO THE SCHOOL.

This is a cooperative plan of the following agencies to do all that is possible to improve the health of the children of Detroit.

Detroit Board of Education  
Detroit Department of Health  
Wayne County Medical Society

Please take \_\_\_\_\_ to your physician for:

1. A health examination
2. Consultation regarding conditions with respect to

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Are the children in your family protected against diphtheria and smallpox?

Date form was given \_\_\_\_\_ Center \_\_\_\_\_

Detroit Department of Health - Division of School Health Service 100M 1-36

So. 441

Fig. 2. Reverse side of record blank.

that during the past year, of the children entering a school for the first time, 32.7 per cent of the elementary, 20.9 per cent of the junior high school, and 22.2 per cent of the senior high school pupils were examined by their own physicians and a report filed with the

school. The information about health secured in this manner was entered on the school record forms the same as was done for the results of the school physician's findings.

The program described in this paper is aimed at freeing the school physician from a large amount of unnecessary work, thus leaving him free to use his particular skills and training with those children who are most in need of his services. Those children who cannot or do not visit their own physicians, and who have obvious defects that are not under medical supervision, are the only ones coming to the attention of the school physician. This group represents those who are in need of the service he has to render. The others are well able to care for themselves and have demonstrated their ability to do so. In order to apply selective screens several devices have been developed. Examination blanks have been designed for and used by private physicians whereby these physicians can inform the school of the health conditions of their patients. School teachers have been trained to do a very satisfactory fact-finding screening type of inspection of the remainder of the students, referring to the school physician those children and their parents who are most in need of this type of health education and guidance. The physician in school then is left free to concentrate on those needing medical care, and education in the manner of obtaining such care.

## FREQUENCY OF IMMUNIZING AND RELATED PROCEDURES IN NINE THOUSAND SURVEYED FAMILIES IN EIGHTEEN STATES<sup>1</sup>

by SELWYN D. COLLINS

THERE are only three or four immunizing procedures that are widely used in the general population as active preventives that are given prior to exposure to disease. Smallpox vaccination is the oldest and most extensively used preventive procedure; Jenner vaccinated the first individual in 1796 or more than eighty years before the beginnings of modern bacteriology and immunology (14). The next of the more frequently used procedures came just one hundred years later when in 1896 the first person was immunized against typhoid fever (19). It was seventeen years later in 1913 that the first individual was injected with diphtheria toxin-antitoxin for active immunization against the disease (18), although diphtheria antitoxin for the treatment of cases and for passive immunization of contacts had been used since 1894. In 1924 the first individual was injected with scarlet fever toxin-antitoxin (15), but immunization against this disease is still in its early if not its experimental stages.

The dates mentioned above in connection with these immunizations refer to their earliest use on human beings. In every instance there was experimental work for a number of years before the procedure was applied to humans and improvement of the process after its first use. Moreover, there is always considerable lag between the first test of the procedure and its general use.

Rabies vaccination and tetanus antitoxin were among the early developments in immunology and are highly successful—they are differentiated here in that they are not used prior to exposure to

<sup>1</sup> From the Division of Public Health Methods of the National Institute of Health, United States Public Health Service. The author is indebted to Dr. Mary Gover for assistance in the preparation of this paper.



conditions which give rise to the disease. Cold vaccine and desensitizing treatments for hay fever and poison ivy are similarly used only for individuals who are definitely susceptible to the diseases. Whooping cough immunization comes in the category of procedures used prior to exposure but it is as yet definitely in the experimental stages.

In the matter of efficacy, ease of application, and general usefulness, smallpox vaccination undoubtedly stands at the head of the list and, as will be seen later, it is also first in frequency. Immunity is developed soon enough after vaccination and is of sufficient duration so that the same procedure is applicable both before and after exposure to the disease.

Active diphtheria immunization is rapidly becoming a contender for first place among immunizations both in efficacy and frequency. However, with the short incubation period of diphtheria, the development of immunity is too much delayed to use the procedure after exposure to the disease, but the earlier method of administering antitoxin to those exposed confers a passive immunity which gives temporary protection.

Typhoid fever immunization has been highly successful and widely used in the Army (19) and Navy (13) but not in the civilian population. The necessity for three injections in each series, and the repetition of the whole process at intervals of not to exceed three years to maintain active immunity, makes the procedure less applicable to populations not under military control.

Scarlet fever immunization has been used less frequently and there are still differences of opinion as to its efficacy and applicability for extensive use.

#### SOURCE AND CHARACTER OF DATA

In connection with a study of illness and medical care which was made by the United States Public Health Service in cooperation with the Committee on the Costs of Medical Care, information on

the frequency of various immunizing procedures was recorded. The data were collected through periodic calls to the homes by visiting nurses for a sufficient time to obtain a twelve-month record of illness and medical care during the years 1928-1931.

The 8,758 white families surveyed included 39,185 individuals living in 130 localities in eighteen states and represented all geographic sections of the United States. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas. The observed group was fairly similar to the general population with respect to age and sex composition, percentage native-born, and percentage married. With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey. More details about the canvassed families are given in a preceding report (1).

Information was obtained on the history of artificial immunizations<sup>2</sup> and clinical attacks of smallpox, diphtheria, typhoid, and scarlet fever at any time prior to the study. For the study year a record was made for these four diseases and also for immunizations and related procedures for other diseases, including the injection of material for the prevention of cold, whooping cough, tetanus, rabies, hay fever, and poison ivy or oak. Some of these procedures are not strictly immunizations but they are all used for the prevention of specific diseases, either before exposure, as in active immunization against diphtheria, smallpox, typhoid, scarlet fever, and whooping cough, or after exposure but before the development of symptoms, as in tetanus and rabies. Injections for hay fever and poison ivy or oak are desensitizing rather than immunizing procedures but their purpose is the same. Diphtheria antitoxin administered to contacts of a case is analogous to the administration of

<sup>2</sup> "Immunization" is used in this paper to mean the injection of the usual number of doses of the material that is presumed to produce immunity to the specific disease; no data are available on tests following the injections to indicate whether the process actually produced immunity in the individual.

tetanus antitoxin after an accident in which the victim may have been infected with tetanus.

This paper reports on the frequency of occurrence of the various types of immunizing procedures with no attempt to appraise their effectiveness in preventing disease.

Table 1. History of immunizations and cases of certain diseases among persons of specific ages, canvassed white families in eight states.<sup>1</sup>

AGE IN YEARS	PERCENTAGE OF PERSONS WITH HISTORY OF:								NUMBER OF PERSONS OBSERVED <sup>2</sup>	
	Immunization at Any Time but No Case				Case at Any Time					
	Small-pox	Diphtheria	Typhoid Fever	Scarlet Fever	Small-pox	Diphtheria	Typhoid Fever	Scarlet Fever		
ALL AGES	54.4	15.8	7.53	1.97	3.05	5.30	4.26	8.83	37,859	
All Ages Under 15	40.9	31.8	4.95	2.80	1.29	3.27	.61	6.90	15,342	
Under 6 Months	2.1	3.6	.33	.66	.06	.33	.06	.11	529	
6-11 Months	4.9	7.5							390	
1	7.8	14.0	.79					.34	889	
2	11.9	20.5	1.25	2.02	.33	1.50	.05	1.25	1,044	
3	12.5	22.8	2.31					2.68	1,082	
4	20.1	28.5	2.65	2.26	.52	1.87	.17	3.97	1,133	
5	27.1	32.8	3.93					4.79	1,171	
6	44.9	37.8	4.49	3.09	.95	3.09	.43	5.79	1,159	
7	57.7	41.5	5.39					7.95	1,169	
8	57.1	42.6	6.22	3.67	1.58	3.76	1.00	7.72	1,204	
9	58.8	43.1	7.26					9.85	1,007	
10	61.6	40.8		4.05	2.58	5.61	11.73	1,077	901	
11	60.9	38.5						12.64	829	
12	65.9	35.6	8.17	3.49	2.98	6.36	1.20	915		
13	63.7	34.0						843		
14	65.5	31.6		3.34	5.76			686		
15	65.0	28.0						708		
16	65.7	19.8		5.95	2.43	12.97	585			
17	62.3	17.8	10.04				2.97	3.61	5.94	575
18	65.8	13.3						487		
19	65.1	11.2		1.23	4.03	6.93	3.70	11.87	2,110	
20-24	66.5	5.3	7.93					3.74	6.69	4.99
25-29	64.2	3.4	7.99	1.42	4.43	6.81	5.70	9.38	3,141	
30-34	65.6	3.7	12.05						4.62	6.49
35-44	63.8	2.9	11.95		4.63	6.57	9.61	3,353		
45-54	61.6	1.6	7.46		3.48	7.31	12.15	1,466		
55-64	61.8	.9	4.30	.59	4.12	8.11	10.69		994	
65 and Over	52.7	.6	1.85							

<sup>1</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the twelve-month morbidity study.

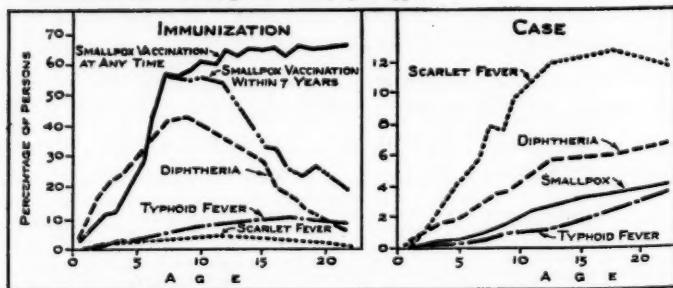
<sup>2</sup> The numbers observed are those known as to history of smallpox; for the other diseases there were from thirteen to fifty-two fewer persons (all ages) because of unknown histories, but in every case the percentages here shown are based on those known as to the history of the disease in question.

## HISTORY OF IMMUNIZATIONS AND CASES AT BEGINNING OF STUDY

Table 1 and Figure 1 show the percentages of persons of specific ages who, prior to the study, had been immunized against smallpox, diphtheria, typhoid, and scarlet fever, together with the percentages who had suffered clinical attacks of these diseases. With the exception of smallpox vaccination within seven years, these percentages represent reports of immunizations or cases at any time in the life of the individual. The curves are therefore cumulative in nature, for a person who was attacked at two, five, or ten years is still in the attacked group at twenty years of age. The curve for diphtheria immunizations does not appear to be cumulative, but the reason for the sharp drop after ten years of age is that active immunization against diphtheria has not been widely used for more than fifteen or twenty years; since artificial immunization is rarely administered to persons over twenty years of age, those individuals who were above that age before the procedure became common have never received the injections. With the continuation of the present rates of injection, the diphtheria immunization curve will approximate the appearance of the smallpox curve when the children who were ten years old at the time of this study become twenty-five years of age.

The curve for scarlet fever immunizations declines for similar

Fig. 1. Percentage of persons of specific ages (a) who had been artificially immunized, and (b) who had suffered clinical attacks of certain diseases—8,758 canvassed white families in eighteen states, 1928-1931.



reasons to those discussed for diphtheria. The proportion of persons who had been vaccinated against smallpox within seven years also declines as age increases; most children are vaccinated at school entrance and as there are few revaccinations this curve declines rather rapidly after 12-14 years of age.

Because immunizations are largely done in childhood, the curves in this paper have been confined to the ages under twenty-five years. Table 1 includes data for the older age groups.

For the preschool ages more children had been immunized against diphtheria than vaccinated against smallpox. This is in agreement with the findings of the White House Conference study (17). However, this was true only in the preschool ages; after the age of school entrance the percentage vaccinated against smallpox was considerably greater than the percentage immunized against diphtheria.

The curves in Figure 1 cannot be taken as representing active immunity at the time of the survey, particularly in the adult ages, because: (a) Many of the vaccinations were done in childhood and never repeated; at 20-24 years of age, only 19 per cent and at 35-44 years only 11 per cent of the persons had been vaccinated within seven years. (b) Schick and Dick tests indicate that a large percentage of adults have acquired immunity to diphtheria and scarlet fever without an artificial immunization or recognized attack of the disease. (c) The immunization curves represent histories of artificial immunizing procedures only; histories of clinical attacks are shown separately in the right half of the figure.

In the older ages, histories of typhoid fever attacks are as frequent as histories of artificial immunizations. Among persons 35-44 years, 8 per cent gave a history of a case of typhoid and 12 per cent gave a history of an artificial immunization without a case; above forty-five years, 11 per cent gave a history of a case and 5 per cent a history of an artificial immunization. For smallpox, only about 5 per cent of adults gave a history of the disease as compared with 66 per cent

who had been vaccinated but had not had the disease. In diphtheria the percentage with histories of recognized attacks is also small as compared with the percentage artificially immunized and the percentage who show immunity by the Schick test. At nine years when the history of active diphtheria immunizations was at the maximum of 43 per cent, 4 per cent of the children gave a history of a recognized attack. Among adults, about 7 per cent gave a history of an attack of diphtheria. The percentage with a history of a recognized attack of scarlet fever is small as compared with the percentage who show immunity by the Dick test but is large as compared with the percentage with a history of artificial immunization. At 10-14 years of age, 12 per cent of the children gave a history of scarlet fever attacks as compared with 4 per cent for artificial immunizations.

Figure 1 represents percentages for the whole group of surveyed persons. It will be of interest to examine the percentages with a history of artificial immunization in various subgroups of the total. In Figure 2 immunizations and case histories have been plotted for cities of different sizes and for rural unincorporated areas. There is a vast difference between large cities and rural areas in the matter of smallpox vaccination, the percentage of adults who had been vaccinated being twice as high in large cities as in rural areas. The curves for small cities and towns under 5,000 fall logically between the two extremes. The history of cases shows the reverse situation, the percentage for large cities being the lowest and for towns and rural areas the highest, with no difference between the two latter categories.

The order of the typhoid fever immunization curves is the opposite of those for smallpox vaccination; rural areas show the highest and large cities the lowest percentages immunized against typhoid. In the matter of histories of attacks, towns and small cities show higher percentages than rural unincorporated areas and large cities. This situation is in agreement with the findings of

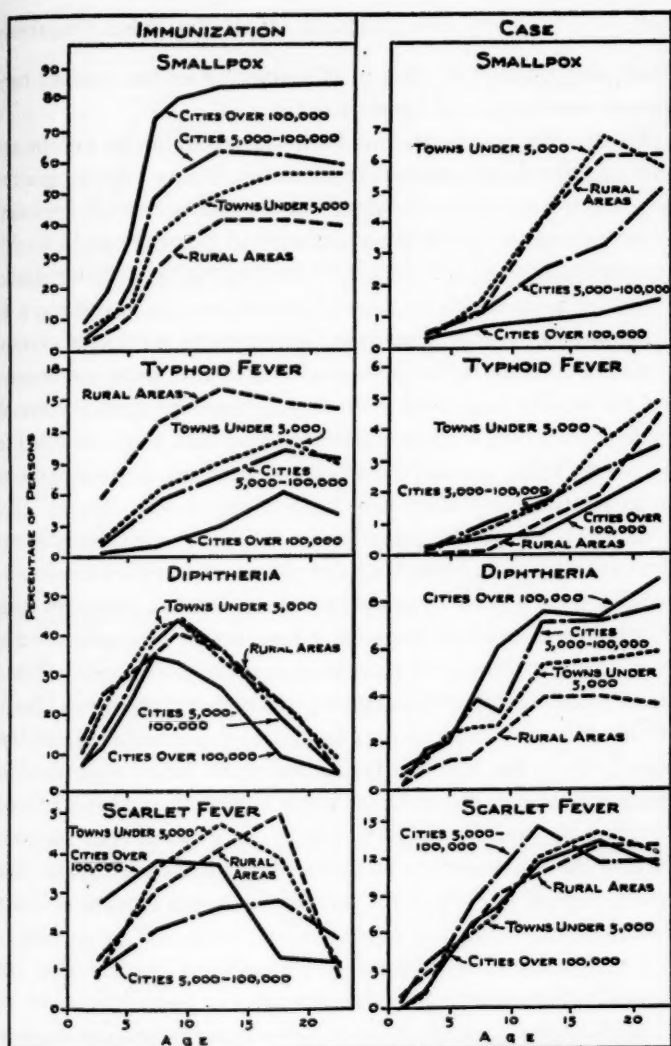


Fig. 2. Percentage of persons of specific ages in cities and rural areas (a) who had been artificially immunized, and (b) who had suffered clinical attacks of certain diseases—8,758 canvassed white families in eighteen states, 1928-1931. (New York State omitted in the diphtheria curves to obtain more comparable groups of cities and rural areas (9).



Leach and Maxcy (16) that in Alabama the lowest typhoid rates occur in rural areas and large cities.

There is not much variation with size of city in the percentage with a history of diphtheria immunization. Figure 2 shows that the large cities have low percentages, but it must be remembered that all rural areas and small towns included in the study had a health department or some other organization employing a visiting nurse. Therefore areas which are most rural and have no health work or nursing service are not represented. Referring to histories of clinical attacks of diphtheria, the large cities show the highest percentages and the smaller towns follow in logical sequence, with the lowest percentages in rural areas. However, these data were collected in the period 1928-1931 and the situations with respect to diphtheria immunizations and cases may have changed considerably since those years. Diphtheria mortality in the registration states in the years 1929-1930 was higher in large cities than in either small cities or rural areas (9). An examination of diphtheria mortality since 1915 in the states of the expanding registration area indicates that in every one of the sixteen years from 1915 to 1930 the rate in urban places (10,000 or more population) was higher than in rural areas, but in all four years from 1931 to 1934 (last available data on this point), the urban rate was below the rural. There appears to be much variation in the different states with respect to the relation of urban to rural diphtheria mortality. In general, rates for rural parts of the South seem to be higher than those for southern cities and in general rates for rural parts of the North seem to be lower than those for northern cities, but in both sections there are numerous exceptions. The situation is changing so rapidly that any generalization must be considered as more or less tentative.

Scarlet fever immunization and case histories seem to show no logical relationship to size of city.

Figure 3 shows immunizations and case histories in the four geographic areas into which the eighteen states have been divided.

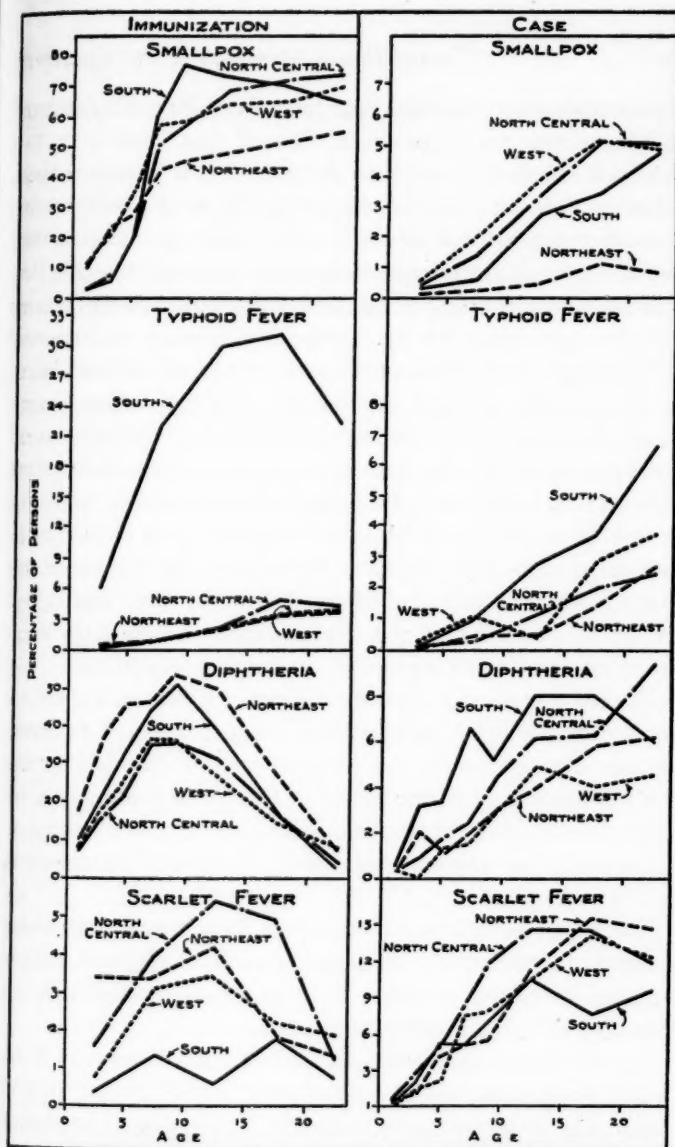


Fig. 3. Percentage of persons of specific ages in four geographic sections (a) who had been artificially immunized, and (b) who had suffered clinical attacks of certain diseases—8,758 canvassed white families in eighteen states, 1928-1931. Surveyed states in each area were:

*Northeast:* New York, Massachusetts, Connecticut.

*North Central:* Illinois, Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas.

*South:* District of Columbia, Virginia, West Virginia, Tennessee, Georgia.

*West:* Washington, California, Colorado.

The Northeast area includes data from three New England and Middle Atlantic states, the North Central data from seven East and West North Central states, the South data from five South Atlantic and South Central states, and the West area includes data from three Mountain and Pacific states. Although there are only 18 states they appear to represent these four areas fairly well (1).

In the matter of smallpox vaccination the only striking variation is the low percentage for the Northeast area where there is very little smallpox and where one usually thinks of well-vaccinated populations. The explanation, however, is obvious when the surveyed population of the Northeast is classified according to size of city. The cities in this region are better vaccinated than those of any other section, but in the rural districts the percentages vaccinated are low. However, the well-vaccinated cities appear to protect the rural districts from the invasion of smallpox, for the percentage with a history of an attack is low in these rural areas. The highest percentage with a history of a smallpox attack occurs in the Western and North Central states with the South intermediate.

The most striking geographic difference shown in Figure 3 is the extremely high history of typhoid immunizations in the South. The South is also high in the history of typhoid cases; immunization was apparently resorted to in an attempt to control a bad typhoid situation. In the matter of case histories, the West comes next to the South but immunization has not been used extensively in that section.

The Northeast and South are high in diphtheria immunization histories and the South is also high in diphtheria case histories. Immunizations in the preschool ages are definitely higher in the Northeast than in any other section.

In scarlet fever immunizations the South is low and the North Central is high. No significant variation appears in case histories except that in several age groups the North Central is slightly above the other regions.

## IMMUNIZATIONS AND CASES DURING THE TWELVE-MONTH STUDY

The record of medical care for illness and preventive service affords data on the frequency of immunizations during the twelve-month morbidity study. These data for the one year, although more accurate than the history records, may represent more frequent or less frequent immunizations than the average for a period of years.

This record for the one year of the study includes a number of

Table 2. Current immunizations and related procedures among persons of specific ages in canvassed white families in eighteen states during twelve consecutive months, 1928-1931.

AGE IN YEARS	SMALLPOX VACCINATION	TYPHOID IMMUNIZATION	DIPHTHERIA ACTIVE IMMUNIZATION BY TOXIN-ANTITOXIN OR TOXOID	SCARLET FEVER IMMUNIZATION	WHOOPING COUGH IMMUNIZATION	COLD, INFLUENZA OR PNEUMONIA VACCINE	TETANUS ANTITOXIN	HAY FEVER DESSENSITIZATION INJECTIONS	DIPHTHERIA ANTITOXIN FOR CONTACTS	SCHICK TEST FOR DIPHTHERIA WITHOUT IMMUNIZATION	POPULATION (YEARS OF LIFE)
ANNUAL IMMUNIZATIONS PER 1,000 POPULATION PER YEAR											
ALL AGES <sup>1</sup>	31.4	4.41	12.6	.73	1.69	3.06	1.17	.65	1.56	1.22	38,544
All Ages Under 15	52.7	4.81	30.5	1.65	3.93	1.96	2.22	.51	3.17	2.91	15,796
Under 5	42.1	2.2	48.1	1.6	7.3	.5	1.8	.2	2.0	2.7	5,513
5-9	70.3	5.1	29.2	1.7	2.1	3.0	2.3	.3	3.7	3.8	5,715
10-14	43.6	7.7	10.7	1.5	2.2	2.4	2.6	1.1	3.9	2.0	4,568
15-19	29.5	8.5	1.3			2.3	1.3	.3	1.3		3,050
20-24	15.1	3.3	.9			1.9	.5		.5		2,119
25-34	19.9	3.5	—			4.4		1.2	.2		5,640
35-44	12.1	4.6	—	.1	.1	3.9	.3	1.0		.04	5,930
45-54	15.5	2.7	—			4.8			.3		3,351
55 and Over	6.5	2.0	—			4.9	.2	.5			2,471
NUMBER OF IMMUNIZATIONS											
ALL AGES <sup>1</sup>	1,209	170	487	28	65	118	45	25	60	47	

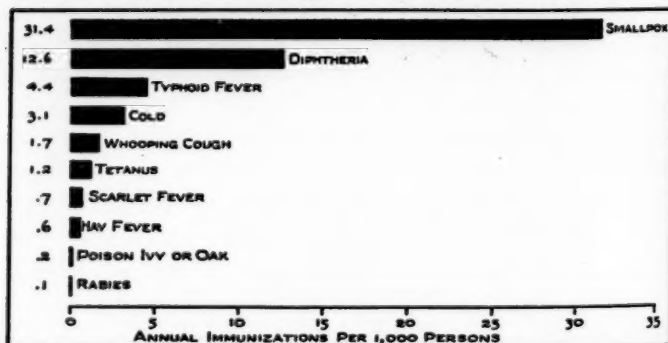
In addition to those shown in the table there were eight series of injections for poison ivy or oak which is 0.21 per 1,000 persons, and five series of injections against rabies or 0.13 per 1,000 persons.

<sup>1</sup> "All ages" includes a few of unknown age.

immunizing procedures not included in the data on histories. As already mentioned, procedures are here included without distinction as to their effectiveness in preventing disease—the purpose of this study was to measure their frequency and not their usefulness. Table 2 and Figure 4 show the frequency of occurrence of the various kinds of immunizations and related procedures during one year in this surveyed group of nearly 40,000 people. Considering persons of all ages, there were 2.5 times as many smallpox vaccinations as diphtheria immunizations, but among children under fifteen years the corresponding ratio was only 1.7. The frequencies of other immunizations were relatively small; it is significant that the use of cold vaccine is fourth in frequency although its efficacy is doubted by many authorities.

Figure 5 shows smallpox vaccination and diphtheria immunization rates in detailed ages to twenty years. In current injections as in histories (Figure 1), diphtheria immunizations are more frequent in the preschool ages than are smallpox vaccinations. However, smallpox vaccination rates rise sharply at the age of school entrance and thereafter continue well above diphtheria immunization rates. There are small numbers of smallpox vaccinations through-

Fig. 4. Annual rates of occurrence of various kinds of artificial immunizations and related procedures per 1,000 population under observation—8,758 canvassed white families in eighteen states during twelve consecutive months, 1928-1931.



out the adult ages but practically no diphtheria immunizations.

Figure 6 shows similar age curves in five and ten-year age groups for the less frequent types of immunization. Scarlet fever and whooping cough immunizations are confined almost entirely to children and are shown only up to twenty years. The other types are more frequent in the adult ages and the entire curves are shown. The highest typhoid immunization rates occur between ten and twenty years with a small secondary peak at forty years of age. The curve for cold vaccine rises definitely as age increases.

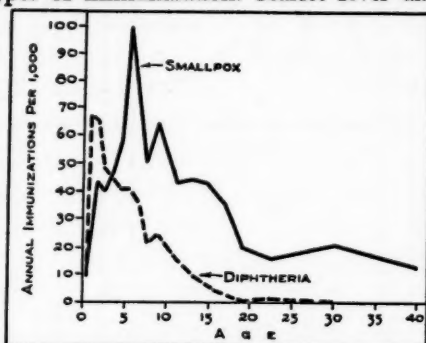


Fig. 5. Annual smallpox vaccinations and diphtheria immunizations per 1,000 persons of specific ages—8,758 canvassed white families in eighteen states during twelve consecutive months, 1928-1931. (Ages used are under 6 months; 6-11 months; single years to 8; two-year age-groups to 20; and five and ten-year age-groups thereafter.)

The use of tetanus antitoxin is confined largely to children; the maximum rate at 10-14 years is five to thirteen times the rates for the age groups above twenty years. In the morbidity study for the same period in this surveyed population there were 2,667 accidents (exclusive of poisoning) and in forty-five of them, or 1.7 per cent, the administration of tetanus antitoxin was reported. The use of tetanus antitoxin was more frequent in injuries by cutting and piercing instruments; a total of 293 such injuries were reported and twenty of them, or 6.8 per cent, were followed by tetanus antitoxin. The maximum percentage occurred for the age group 5-9 years in which 11.8 per cent of the seventy-six cutting and piercing accidents were followed by tetanus antitoxin.<sup>3</sup> Among the eighty-

<sup>3</sup> The percentage of cutting and piercing accidents that were followed by tetanus antitoxin were: under 5 years, 9.8; 5-9, 11.8; 10-14, 8.8; 15-24, 2.8; 25 and over, 1.2 per cent.

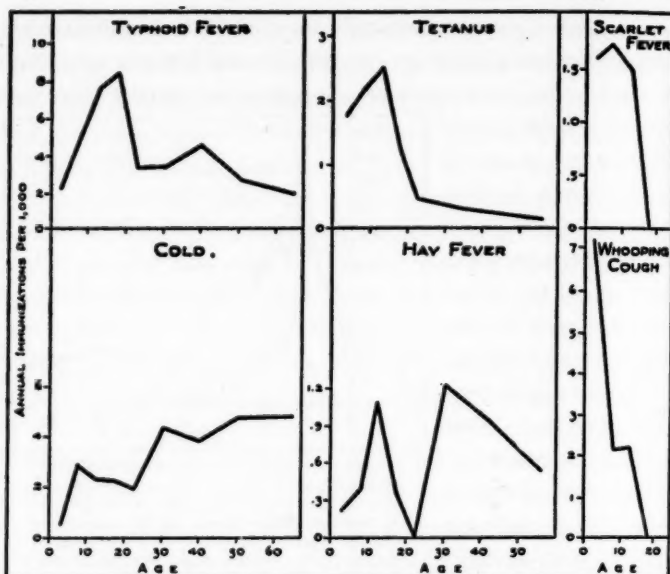


Fig. 6. Annual artificial immunizations and related procedures of certain kinds per 1,000 persons of specific ages—8,758 canvassed white families in eighteen states during twelve consecutive months, 1928-1931.

three accidents of this type for persons over twenty-five years of age, 1.2 per cent were followed by tetanus antitoxin. Many more such cutting and piercing accidents occurred among boys than girls but the percentages followed by tetanus antitoxin were not significantly different.

Hay fever desensitizing injections showed peaks of approximately equal size at ten to fourteen and twenty-five to forty-four years of age; although the numbers are small, the curve seems to be fairly correct since these two peaks correspond roughly in age to peaks in the incidence of hay fever as reported in these families during the same year (6). Desensitizing injections are given for both hay fever and asthma; 25 per cent of the seventy-six cases reported as hay fever were taking the injections, but only 4 per cent of



the 150 cases reported as asthma. Among the twenty cases designated as hay fever that were less than twenty years of age, 40 per cent were taking the injections as compared with 20 per cent among the fifty-six cases over twenty years of age. It seems doubtful whether 25 per cent of hay fever victims actually take desensitizing injections; it is probable that the enumerators who canvassed the families were more likely to receive a report of hay fever if the patient were taking injections than if no such treatments were being given.

Figure 7 shows from data for the general population of the eighteen surveyed states (11, 12) the seasonal curve of smallpox, diphtheria, and typhoid fever cases and deaths in terms of the percentage occurring in each month, with adjustment to a thirty-day basis. Along with these curves are similar ones for immunizations in the surveyed population. For smallpox vaccinations there is a curve for twelve localities which reported a large number of vaccinations in the face of actual or threatened epidemics, and an-

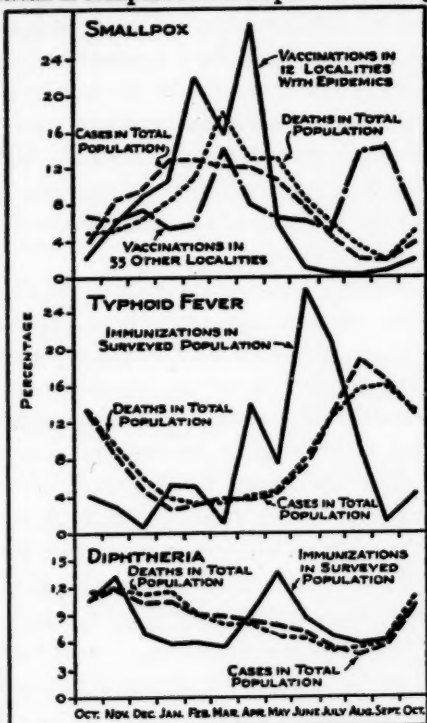


Fig. 7. Percentage of artificial immunizations, of clinical cases, and of deaths for smallpox, typhoid, and diphtheria in each month (thirty-day basis)—immunizations in the surveyed families in eighteen states, 1928-1931; cases and deaths in the total population of the eighteen surveyed states, 1929-1930.

other for fifty-five localities which reported few vaccinations. Smallpox vaccinations were greatly concentrated in those localities that had actual or threatened epidemics, 74 per cent of them occurring in twelve such localities. In Figure 7 it is seen that the great majority of vaccinations in these communities came at the high season of smallpox cases and deaths. In the fifty-five localities with few vaccinations there was also a peak of vaccinations at the season when smallpox was prevalent but equally high percentages for August and September which must represent preparation for school entrance. The season of high incidence of smallpox cases and deaths is January to April.

There is little or no evidence of the extensive use of typhoid fever immunization in the face of epidemics. However, there is a definite peak in the frequency of immunizations in June which may be in preparation for the vacation season but more probably represents the time when health departments urge the use of the procedure. The high typhoid season comes in August and September.

The high season for diphtheria cases and deaths is October to January. There is a peak in diphtheria immunizations in November but it is largely due to a single community, whereas the peak in May is the result of immunizations in many communities. Apparently the seasonal incidence of the disease has little to do with the month of immunization against diphtheria; the late spring seems to be the favorite time selected by health departments for diphtheria immunization work.

The high season for scarlet fever cases and deaths is January to April. There were only twenty-eight scarlet fever immunizations during the study year so no attempt was made to determine the usual seasonal distribution of the procedure.

Figure 8 shows the percentage of immunizations of different kinds that were done in public clinics. Diphtheria stands at the top with 57 per cent, typhoid next with 52 per cent, smallpox with 42, and scarlet fever with 36 per cent. Few of the other types of im-

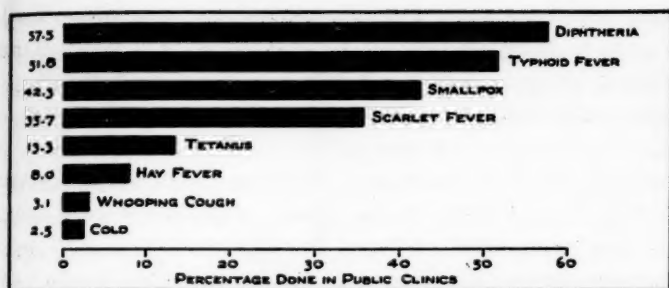
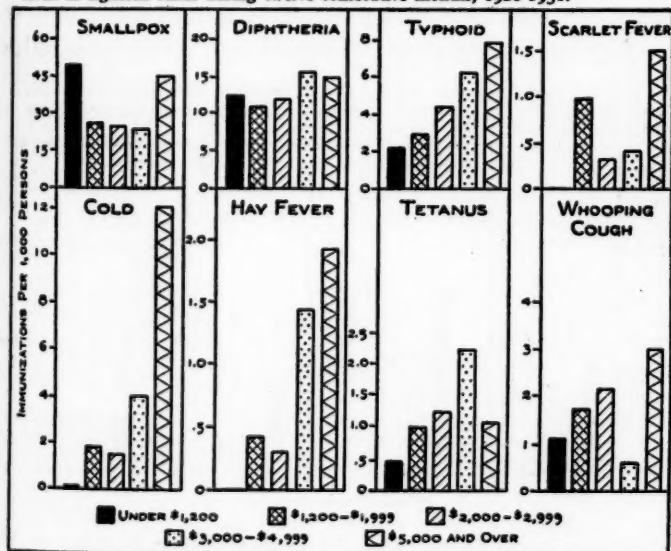


Fig. 8. Percentages of various kinds of artificial immunizations and related procedures that were done in public clinics—8,758 canvassed white families in eighteen states, 1928-1931.

munization are done in public clinics. The maximum percentage of immunizations that were done in public clinics occurs in the school ages but in the case of typhoid fever the percentage was

Fig. 9. Annual rates of occurrence of various kinds of artificial immunizations and related procedures per 1,000 persons of all ages in families of different income levels in eighteen states during twelve consecutive months, 1928-1931.

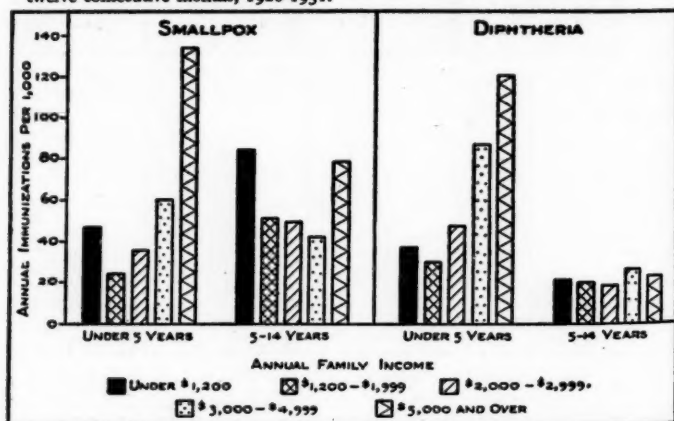


almost as high for adults. This may represent a greater use of clinics by adults in the South where most of the typhoid immunizations occurred. About 90 per cent of the immunizations of all types in public clinics were reported as free with the other 10 per cent paying either a nominal or a full charge.

Figure 9 shows current immunization rates per 1,000 for persons of all ages in each of five income groups. There is not much variation with income in the frequency of diphtheria immunizations; smallpox vaccinations occur more frequently in the lowest and highest income groups with little variation among the three intervening classes. Since these standard types of immunization are so largely obtainable through clinics and health departments, no large variation with income would be expected. The frequency of typhoid immunizations shows considerable rise as income increases, but the use of cold vaccine and hay fever desensitizing injections increases greatly with income, thus indicating that they are considered as luxuries in the field of preventive medicine.

In Figure 10, smallpox vaccination and diphtheria immunization

Fig. 10. Annual smallpox vaccinations and diphtheria immunizations per 1,000 children of specific ages in families of different income levels in eighteen states during twelve consecutive months, 1928-1931.



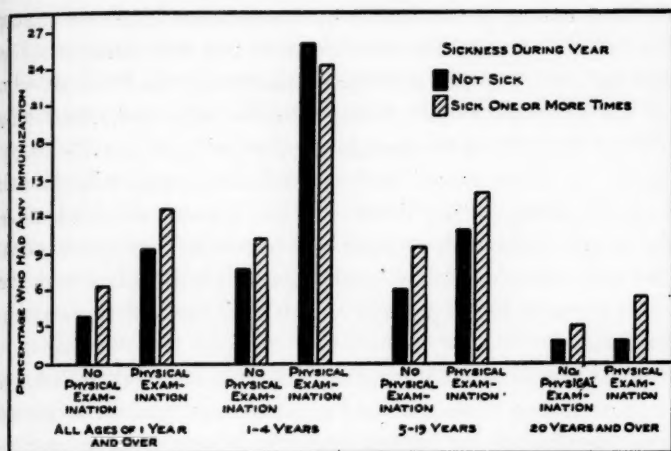


Fig. 11. Percentage of persons of specific ages who had an immunization of some kind during the study year among persons classified according to whether they had a physical examination and whether they were sick during the year—8,758 canvassed white families in eighteen states during twelve consecutive months, 1928-1931.

rates are shown by income for the preschool and the school ages. In the preschool ages when these preventive services are not readily available through the schools, vaccinations and immunizations are more frequent in the higher income groups. In the school ages, when school clinics are available, there is not much variation with income except that the lowest and highest groups have more small-pox vaccinations.

Physical examination and sickness records are available for the surveyed population for the same period as the immunization records. In Figure 11, individuals of different age groups have been classified according to whether they received a physical examination and whether they were sick during the study year. For each of these classes the bars represent the percentage of persons who had one or more immunizations during the study year. Considering persons of all ages who were not sick, immunizations were more than twice as frequent among those who had a physical exam-

ination as among those who had no examination. Similarly among those who were sick, the immunization rate was about twice as high for those who had a physical examination as for those who did not have this service. Comparing the sick with those who were not sick during the year, in the class with no physical examination the immunization rate was somewhat higher in the sick group. Similarly among those who had a physical examination, the rate was higher among those who were sick. Physical examinations must have stimulated immunizations but contact with the doctor through illness appears also to have resulted in some immunizations.<sup>4</sup>

In the preschool age immunizations were two to three times as frequent among those who had physical examinations as among those who did not, but sickness had little relation to the immunization rate.

#### SUMMARY

Information on the history of artificial immunizations and clinical attacks of smallpox, diphtheria, typhoid, and scarlet fever, and more detailed records of immunizations of all kinds during a twelve-month period between 1928 and 1931 were obtained on 8,758 white families in 130 localities in eighteen states. Each family was visited at intervals of two to four months to secure the data.

At the age of the maximum for histories of artificial immunizations, there were the following percentages with an immunization prior to the study: smallpox, 66 per cent at 20-24 years; diphtheria, 43 per cent at 9 years; typhoid, 10 per cent at 15-19 years, and 12 per cent at 30-34 years; scarlet fever, 4 per cent at 10-11 years. At the age of the maximum for case histories there were the following percentages with a history of a prior attack of the disease: scarlet fever, 13 per cent at 15-19 years; diphtheria, 7 per cent at 20-24 years;

<sup>4</sup> Some procedures, such as the administration of preventive doses of tetanus anti-toxin and hay fever desensitizing injections would always be accompanied by the illness or accident for which the injections were given, and in a small percentage of cases there would be reactions following smallpox vaccinations and diphtheria, typhoid, and scarlet fever immunizations. However, both of these types of cases are rare and probably do not account for all of the excess of immunizations among those who were sick during the study year.

smallpox, 4 per cent at 20-24 years, and 5 per cent at 45-54 years; typhoid, 4 per cent at 20-24, and 12 per cent at 55-64 years (Figure 1).

Large cities show twice as many smallpox vaccinations as rural unincorporated areas but fewer histories of smallpox attacks. Rural unincorporated areas show more than twice as many typhoid immunizations as large cities (Figure 2).

Typhoid immunization histories were many times more frequent in the South than in other geographic sections. Histories of clinical attacks of typhoid fever were also frequent in the South (Figure 3).

In the preschool ages diphtheria immunizations were more frequent than smallpox vaccinations, but above five years the reverse was true (Figure 5).

The seasonal variation in the frequency of smallpox vaccinations and typhoid immunizations seems to be related to the seasonal prevalence of the disease, but this is not true of diphtheria (Figure 7).

A higher percentage of diphtheria immunizations were done in public clinics than of any other type of immunization (Figure 8).

The use of immunizing procedures other than those for smallpox and diphtheria tends to increase with income, particularly for cold vaccine and hay fever desensitizing injections (Figure 9). Smallpox and diphtheria immunizations done in the preschool ages increase with income but in the school ages there is not much relation to income (Figure 10).

More immunizations occurred among persons who had a physical examination during the year than among those who did not. In adult ages immunizations were more frequent among those who were sick than among those who were not sick during the year (Figure 11).

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## HEALTH INDICES<sup>1</sup>

A STUDY OF OBJECTIVE INDICES OF HEALTH IN RELATION TO  
ENVIRONMENT AND SANITATION

by K. STOUMAN AND I. S. FALK

### 5. INDICES OF ENVIRONMENT

ENVIRONMENT has always been one of the most important factors determining health and longevity. In view of the amazing reduction of mortality effected at certain periods of life and considering the relatively small sums spent on public health, sanitation has been eminently successful. It is probably the signal nature of this success which has led to the relative disregard, in the public health reports of countries and towns in temperate climates, of factors of environment and to the emphasis upon information concerned with activities directed at human beings for the betterment of public health.

This tendency is hardly justified. Even though the deleterious influence of *natural* environment has now been greatly reduced, that of *artificial* environment persists and has, on the whole, been only insufficiently dealt with from a health point of view. No attempt to appraise the health situation of a community would be adequate if it neglected the social, economic, and cultural background of the population.

The principal chapters on environment (B) which are proposed for inclusion in the system of Health Indices are:

- I. Climate
- II. Topography and Density of Population
- III. Occupation

<sup>1</sup>The first section of this report was published in the January, 1937, issue of the *Quarterly*. The complete manuscript of the report, including the accompanying schedules and the findings of a trial application of the indices in New Haven, Connecticut, was published in the December issue of the *Quarterly Bulletin of the Health Organisation of the League of Nations*. Because of space limitations only the text of the main report has been published in the *Quarterly*, although the Fund has made available a limited supply of the complete monograph for distribution in the United States.

- iv. Distribution of Wealth
- v. Cultural Level
- vi. Illegitimacy and Prostitution
- vii. Housing
- viii. Nutrition
- ix. Consumption of Alcoholic Beverages, etc.

B-I and II. *Natural Environment.* Although the free influence of natural environment upon health has been greatly reduced by sanitation, it cannot yet be considered a negligible factor. The peak of summer mortality has been leveled wherever modern methods of sanitary control have been enforced, but the peak of winter mortality persists. It will therefore be useful to have information not only on the temperature but also on the number of hours of sunshine in the different seasons of the year. The altitude and the nature of the soil are also factors to be considered.

Even more important are the geographical factors in which natural and artificial environment combine to determine the extension of suburban settlement around the city. The diffusion of a large part of the population under semi-rural conditions should relieve congestion and, normally, have a favorable effect upon health. However, this is not always so; on account of inadequate organization, suburban administration frequently fails to take full advantage of the benefits offered by nature. But indices of the principal characteristics of the suburban extension must be available in order to judge the success of sanitary control and the relationship between the town and its surroundings. Such indices will notably cover the density of population in the various zones and their relation to the urban density, the nature of the settlement, the establishment of industries, and the proportion of rural farm population left in the area.

B-III to VI. *Characteristics of the Population.* The demographic and racial characteristics of the population have been treated in Part A of the indices. Its occupational distribution belongs to the

second part; occupation determines, for at least half the day, the place of work and, to a large extent, the habitual environment of the gainfully occupied persons. The classification cannot be very detailed, but by using only broad groups many differences in the various census classifications will be eliminated or avoided. It is essential to show the proportion of women and children who are occupied otherwise than at their own housework. This, in itself, is a valuable social index. Other indices of general interest are the proportion of domestic servants and the proportion of persons occupied in the liberal professions. Information can be obtained in many countries also in regard to position in the industry, whether employer or employee, and as to the proportion of the population which may be counted as falling within the "laboring classes."

Information concerning economic conditions comes from more varied sources. In some countries, census returns give the population according to distribution in income classes assessed for taxation. Where the limit for income tax is very low, income distribution is the best index of the distribution of wealth. Indices concerning the part of the population which is below the income tax limit may be found in the ratio of persons assisted by public or private agencies and in the prevalence of unemployment. The former ratio should, however, be used with caution, because it depends to a considerable extent upon the relief funds available and upon the policy pursued in this respect. Where nothing more definite is available, rentals paid may frequently give the best indices of the distribution of the population according to economic situation. Automobiles registered and telephones per hundred inhabitants may furnish valuable indications regarding the prosperity of a locality.

The cultural level of the population determines to a large extent the ability of the community to adapt itself to its environment and to profit by the technique of healthful living. The cultural level, being, so to speak, an intangible element, cannot be directly meas-

ured and expressed in statistics. Indications can be found, to a certain degree, in the percentage of illiteracy, in school attendance at various ages, in the number of volumes in public libraries, and sometimes in the circulation of newspapers and magazines. It is true that culture does not consist merely in reading and does not come only from attendance at school, but these are nevertheless among its most important bases.

It is more difficult to find indices concerning the moral level of the population. The prevalence of illegitimacy and the institution or abolition of prostitution have some bearing upon this, although they do not have the same meaning in all countries. Information in these respects should, at any rate, be included, because such indices deal with aspects of the subject which have a direct bearing upon public health.

**B-VII. *Housing.*** Housing is probably the most important element of environment. Men spend, on the average, at least one-half of their time at home, women and children more. The majority of houses, in any country, are not up to the level of reasonable modern requirements, and overcrowding affects a part of the population in any town in the world. Health conditions cannot be adequately described without due reference to housing.

Census reports contain, in many countries, fairly detailed information concerning housing and the occupancy of houses. Special housing surveys have been made for selected areas of other countries. To this may be added special slum surveys made in various large cities. Where such information does not exist, the necessity for obtaining it cannot be sufficiently emphasized.

Wherever available, housing statistics have the advantage over most other social statistics of being complete, definite, and objective. The nature of the house and the number of rooms, as well as the number of occupants, can be expressed in quite simple numerical terms. The accommodation available can be summarized by a tabulation of the distribution of houses into one-family and

two-family houses and apartment or tenement houses, and of the dwellings according to number of rooms.

It is true that no international definition exists in regard to what is considered a room. In some countries, the kitchen is counted as a room; in others, not. In France, any space large enough for a bed is counted as a room. It should not be too difficult, however, to reach an international agreement in this respect. The proposal toward such an agreement which might be worked out by a committee of experts could also profitably include a list of other items for which information should be asked in a housing census.

The room in itself is an element of fundamental importance, because it allows segregation of sleeping quarters in the family. But not less important is the volume of air space, as small rooms obviously have not the same hygienic value as large rooms. Information is rarely available in this respect, but efforts should be made to obtain it, as it would allow of a more precise evaluation of the problem of overcrowding. Small rooms are the rule in the poorer sections, and overcrowding is therefore really worse there than would appear from the statistics of persons per room.

More than one but less than two persons per room is usually considered as overcrowded, two persons or more per room as seriously overcrowded. These may be fair measures so long as the rooms are of reasonably good size and are provided with necessary light and air. It would be preferable, however, to distinguish the inhabitants as between adults and children, because the latter, if small, can better be placed together without serious overcrowding resulting.

More difficulty is experienced in establishing indices of the quality than of the quantity of housing. Quality is always to a large extent a matter for subjective consideration. Certain objective, quantitative measures nevertheless throw light upon the quality of housing. Such measures are: the proportion of dwellings provided with individual bathrooms, with individual water-closets, with

central heating; the proportion of dark or semi-dark rooms; the proportion of dwellings partly below street level. Such indices convey more information than that which they specifically contain, because, for example, a dwelling with individual bathroom and central heating already attains a certain definite standard of quality; conversely, flats without individual water-closets signify a low type of housing.

Information can frequently be obtained from the building inspection service regarding the number of houses, flats, and rooms built each year. The ratio of those built during the last ten or fifteen years to the total numbers available furnishes a significant index of the rate at which old housing is being replaced. Though new houses are not always better than old ones, generally they are, and this index is therefore apt to contain a qualitative element.

The percentage of vacant dwellings according to number of rooms will show whether there is a real shortage of housing accommodation or whether such overcrowding as may exist is due entirely to the inability of a part of the population to pay for adequate living quarters.

Finally, the housing indices should include statistics of the population living in hotels, lodging houses, or institutions.

Certain houses, streets, or areas are slums less because the buildings are grossly inadequate than because the inhabitants make them slums by their disorder, uncleanliness, and slovenliness. Records of cleanliness of houses and yards are frequently kept by the sanitary inspectors, but such reports must necessarily remain subjective; practical objective standards could scarcely be devised.

**B-VIII. Nutrition.** Wholesome and adequate nourishment undoubtedly contributes as much to the building-up of health as does good housing. Indices of consumption of alimentary products are much more difficult to obtain, however, than indices of housing. The approximate amount of the principal food products consumed can sometimes be calculated for the country as a whole from the



statistics of production and of net importation. Such data cannot be procured for individual cities, except occasionally for certain products under special sanitary control—such as milk and cream.

Even if such statistics were available, they would throw only scant light upon the daily fare of that poorest part of the city population for whom the obtaining of adequate nourishment constitutes a real problem. A 10 per cent lowering of the food consumption among that 10 per cent of the population where it was already scanty would mean a lowering of less than 1 per cent in the total consumption of the entire population, but such a change might still suffice to bring a considerable increase in community ill health through undernourishment. Too much useful direct evidence should therefore not be expected from statistics of this type.

Better data might be obtained from careful surveys of family food budgets in various economic and social classes of the population. Such research has been carried out in several localities and should be utilized, whenever available, for the city being surveyed.<sup>2</sup>

Direct evidence of malnutrition may be obtained from the medical examination of school children. If such data are to be used at all, it is necessary to use measurements which are more objective than the personal opinions of examining physicians. Interesting suggestions in this respect are contained in the New York City survey of physical defects among school children, which advocates the ratio of arm girth minus chest depth to hip width as a good measure of the state of nourishment.<sup>3</sup>

**B-IX. Consumption of Alcoholic Beverages.** Alcoholic beverages being subject to tax in practically all countries, statistics of their consumption are usually available. Such data may, at times, be obtained also for cities or other local administrative areas. Such indices may be of interest in connection with the prevalence of alcoholism.

<sup>2</sup> See Wiehl, Dorothy G.: Diets of Low-Income Families Surveyed in 1933. *Public Health Reports*, United States Public Health Service, January 24, 1936, 51, No. 4, pp. 77-97.

<sup>3</sup> See Fransen, Raymond: Physical Measures of Growth and Nutrition, Monograph II of the School Health Research Series; and Physical Defects; The Pathway to Correction, American Child Health Association, New York.

## 6. INDICES OF ADMINISTRATIVE ACTIVITY

The third part of the Health Indices deals with administrative measures undertaken to safeguard and improve public health. This part therefore has much in common with the American Appraisal Form, and comparability has been preserved as far as possible. It has not been thought advisable, however, to constitute this part of the Health Indices as a mere extract from the Appraisal Form, with omission of standards and scores; the purposes of the Appraisal Form and of the system of Health Indices are not altogether identical. The Appraisal Form is chiefly designed to rate the activity of city health departments and allied official or voluntary organizations working in the same fields. The third part of the Health Indices, while also attempting to formulate numerical expressions for these activities, has the special function of being an auxiliary in the interpretation of the indices of the first two parts. It must therefore cover all activities relating to public health and care of the sick, whether or not they fall within the competence of the health department or of the public health agencies.

Part C of the Health Indices contains twenty-four chapters. Ten of these are adapted from the Appraisal Form, and three others are based upon the rearrangement of information which is also contained in that document. Two other chapters (Expenditures and Personnel) are dealt with in the Appraisal Form only insofar as the health department is concerned. For three subjects, there is no special provision in certain countries (none in the United States generally) namely: health insurance, invalidity care, and care of the aged. The remaining six chapters concern problems with a definite public health aspect which are being dealt with in one way or another in nearly all countries. These are: physical education, housing, industrial hygiene, care of the insane, hospital facilities, and medical assistance.

The chapters of the third part (C) of the Health Indices are:

- I. Community Expenditures on Sickness and Public Health
- II. Sanitary Personnel
- III. Vital Statistics
- IV. Laboratory Services
- V. Acute Communicable Diseases
- VI. Venereal Diseases
- VII. Tuberculosis
- VIII. Other Diseases
- IX. General Public Health Nursing
- X. Maternity Hygiene
- XI. Infant and Preschool Hygiene
- XII. School Hygiene
- XIII. Physical Education
- XIV. General Sanitation
- XV. Food Inspection and Nutrition
- XVI. Housing
- XVII. Industrial Hygiene
- XVIII. Health Instruction
- XIX. Care of the Insane and Feeble-minded
- XX. Hospital Facilities
- XXI. Health Insurance
- XXII. Free Medical Assistance
- XXIII. Invalidity Care
- XXIV. Care of the Aged

This is a very long list, and each of the chapters contains many questions. It cannot be shorter, however, if the entire field is to be fully covered. It is very likely, however, that a much abridged list, including only the cardinal points of public health activities, may be substituted for most practical purposes. This possibility will be discussed in the following chapter, and it will be emphasized that an abridged list can attain definite form only after experimental use in several countries.<sup>4</sup>

*C-I. Community Expenditures.* No score is given for budget in the American Appraisal Form, although the principal items of the health department budget are recorded. Those who were respon-

<sup>4</sup> This discussion is published in the complete report.

sible for the Appraisal Form wanted to know what was being accomplished in a community rather than how much money the health department could spend.

The short form used for the American Health Conservation Contests takes the opposite line and includes budget as a scoring item, arguing that the provision of funds is a significant expression of community interest in public health.

There is much to say in favor of each point of view. It would be difficult to justify complete omission of reference to budget in the Indices; budget is fundamental among the elements which determine the possibilities for extension of public health activities.

The question of expenditures on sickness and public health is probably the most difficult of all which come within the scope of the Health Indices. It must be remembered that the budget of the local health department constitutes only a fraction of these expenditures. Provincial and national health departments also spend on public health for the benefit of each locality, and it is difficult to determine exactly what proportion of the expenditure may be properly charged to the city or district in question. Voluntary associations contribute to the health work and so do the social insurance systems wherever they exist. In addition, there is the budget of the hospitals and of similar institutions which, in the aggregate, frequently exceed that of the health department. This brings us into the very complicated question of the costs of medical services. It might be decided that such expenditures should be included—they certainly serve definite public health functions—when they are met from tax funds or from voluntary contributions. However, there is little practical difference between taxes and compulsory contributions to national insurance schemes, so that a line of separation between the two is in a measure academic.

It may be thought preferable to exclude the costs of medical care altogether, but it is difficult even to distinguish clearly between these costs and the costs of public health activities. The care of

epidemic diseases, tuberculosis, and venereal diseases are usually, and properly, considered as part of any system of preventive medicine. But then, apart from traditional practice, it seems arbitrary to include some diseases and exclude others which also have an important or direct reaction upon the state of the public health.

The problem of community expenditure in respect to sickness and public health is obviously a very difficult and complicated one in any particular community. It becomes much more so when the subject must be considered internationally, because so much depends upon the administrative organization and the general policy followed in each country. Everything turns really upon the extent to which the general health program is related to, or is based upon, organized care of the sick.

A chapter on expenditure has been included in the present schedules, because the authors think it is an important element in the evaluation, but it has been done without much confidence that the proposed draft will prove final or that it can be fully used anywhere. It would probably be very desirable to have this whole subject thoroughly examined by an international group of experts who might establish categories which might offer an opportunity for rough comparison.

*C-II. Sanitary Personnel.* The personnel of the local health department is included as a nonscoring item in the American Appraisal Form. It seems desirable to add to this the technical personnel of other official or voluntary bodies engaged in public health work.

Apart from this, it would seem useful to show the numerical strength of the entire sanitary profession—physicians, dentists, nurses, *et cetera*—in order to have an indication of how far the requirements of the population in this respect are met. A definite deficiency in one category or the other is apt to have an unfavorable influence upon the state of public health.

*C-III. Vital Statistics.* The questions concerning vital statistics

are divided into five sections of which three cover the main points where inexactitudes are most apt to arise: correction for residence, verification of certificates, and certification and tabulation of causes of death. These questions have not been fully dealt with in the Appraisal Form, and it is strange that the question of correction for residence should not have been posed at all.<sup>5</sup> It is the most important of all because the errors due to omission of this correction may be so great that the compilation of statistics might as well be dispensed with.

Some of the questions which are new to the Health Indices schedule are included for reasons of international comparison, such as the percentage of deaths medically certified, whether or not the medical statement of the cause of death is confidential, the percentage of deaths ascribed to unknown or ill-defined causes, and the use of the international list of causes of death. Other questions, besides that concerning correction for residence, would be of interest even for comparisons among American cities, as, for example, the percentage of deaths on which an autopsy was made and the inquiries into insufficiently specified causes of death.

**C-IV. Laboratory Services.** The Appraisal Form does not attempt to give a full account of the public health laboratory activity, but singles out certain analyses as being the most important and eventually characteristic for the rest. These are: typhoid fever, diphtheria, tuberculosis, syphilis, gonorrhea, milk and cream, water, urine from prenatal cases, and total laboratory procedures. This may be fully justified for a short list but does not do sufficient justice to new developments in this field, which should be encouraged. It may also unwisely encourage the neglect of other analyses by the inference that they are not important because not shown or rated.

The present schedule has attempted a more systematic classification of laboratory procedures into specimens of human and other

<sup>5</sup> Except that correction for residence is provided in the mortality tabulations which are included in the (nonscored) general information items of the introductory section.

origin and given more details of bacterial examinations. It adds water examinations other than those of the public water supply.

It may be added that the standards set by the Appraisal Form for bacterial analyses of specimens of human origin seem altogether insufficient to allow for preventive work on contacts, food handlers, *et cetera*, which should be systematically pursued. Such low standards might easily discourage good work.

*C-V. Acute Communicable Diseases.* The sections of this chapter are notification, case investigation and recording, hospitalization, control of contacts, control of carriers, diagnostic service, visits to cases, and immunization. Most of these elements are found in the Appraisal Form, although they are arranged somewhat differently.

The number of cases notified per death has been used as a criterion for the quality of the notification, as in the Appraisal Form. It is not a perfect measure, as the case-mortality rate varies from one locality to another and even from one epidemic to another, but it is difficult to devise a better one. So long as no standards are set but the figures left to speak for themselves, an evaluation can, to some extent, be based on local knowledge of the gravity of each disease. The ratio of cases discovered to deaths is particularly important in the case of acute poliomyelitis which has not been mentioned at all in the Appraisal Form, although it now constitutes a more serious problem than some other epidemic diseases of childhood. If the case-mortality rate is high, it is almost certain that the non-paralytic cases have not been properly traced.

The search for carriers is an important element in the control of several epidemic diseases, and especially so in the case of typhoid fever; it should therefore be included in the schedule. In a community where typhoid and diphtheria control are well established, more carriers than cases may be found.

It would also be desirable to show more complete information concerning immunization than that given in the Appraisal Form which covers only smallpox and diphtheria. It is probable that



scarlet fever immunizations will soon become an established part of the ordinary health program, and others are likely to follow. BCG has already been widely employed in Europe, and vaccinations against the epidemic diseases of intestinal origin constitute an important element of control when epidemics threaten or occur.

*C-VI. Venereal Diseases.* The incidence of venereal diseases varies widely from one country to another, between cities and rural districts, and even among cities in the same country. The reported incidence of syphilis is thus five times higher in New York than in nearby New Haven, where the reporting is undoubtedly equally good. It is therefore quite unfair to establish any given number of cases per 100,000 inhabitants as a measure of the completeness of reporting. The 600 cases of venereal diseases per 100,000 population which the Appraisal Form sets as a standard for good reporting are not reached in Denmark or Sweden, where the reporting is above suspicion.<sup>6</sup> Many American cities do not reach this incidence of 600 cases by a wide margin.

When dealing with venereal disease reporting, it is essential to keep syphilis and gonorrhea apart. Syphilis is taken seriously everywhere, gonorrhea—although wrongly—generally is not. In some cities where 80 per cent or 90 per cent of the syphilis cases are probably reported, gonorrhea reporting may not cover 20 per cent of the existing cases. A great many cases will not even come to the attention of a physician, and if they do, he will frequently not trouble to report them. Gonorrhea is undoubtedly on the whole now more widespread than syphilis. Yet, reported gonorrhea cases amount in a great many towns only to a fraction of the reported syphilis cases. Syphilis reporting can be, and generally is, checked against the positive Wassermanns, but many physicians do not send in a smear for gonococcus examination when the diagnosis is obvious. It is altogether misleading to strike an average between two

<sup>6</sup> The level reached in 1935 was 184 cases per 100,000 population in Sweden and 293 cases in Denmark. The corresponding incidence of syphilis alone was only seven and twenty-three cases, respectively, per 100,000 inhabitants.

such widely different ratios, because such an average will be true for neither. All statistics of venereal disease control must therefore be kept separate for syphilis and gonorrhea, while soft chancre may be omitted altogether, because it is no longer of any practical importance.

Clinics and hospitals report their venereal disease cases, practicing physicians may or may not. One indication of the quality of reporting is therefore to be found in the proportion of cases reported by practicing physicians. Such indications are subject to reserve if the public clinics do not reach a reasonably normal share of the cases, owing to lack of accessibility or to other shortcomings.

Statistics of the activity of clinics, of examination of contacts and other tracing of sources of infection, and of control of cases under treatment, should give an indication of the amount and quality of work performed in this field.

C-VII. *Tuberculosis*. Tuberculosis control probably gives, together with infant hygiene, the best test of the efficiency of the health service. Tuberculosis is, at the same time, a communicable disease and a social disease. It can be reduced to a quite low level; but this cannot be done without considerable and sustained effort, nor can it be done by any single measure. Its control is more complicated than that of typhoid fever or diphtheria; it is numerically of far greater importance; it has a definite social aspect, and the final success of the campaign is more distant. The earnestness and skill with which the community has attacked the tuberculosis problem is therefore a good index of the whole public health effort. It reaches from the health department and the institutions of treatment through the visiting nurses out into the home and the factory and is closely related to social and housing problems. Success in tuberculosis control, more than in any other branch of public health work, therefore denotes joint planning in many fields and by many groups. Such activity usually has repercussions on the public health in general.

The organization of tuberculosis control is based on four principal elements: case-finding and recording, clinical service, field nursing, and institutional care. The other elements of control are more or less auxiliary to these. Both the Appraisal Form and the Health Indices are therefore based upon these four main sections.

The cornerstone of the whole fabric is the tuberculosis register, which assures control and supervision of the individual cases and discovery of new cases among the contacts as well as the detection of conditions favorable to the spread of the disease. The first important test of tuberculosis control is therefore to know whether or not the register is fairly complete.

The Appraisal Form sets as its only test in this respect the standards of two new cases and five cases on the register (exclusive of hilum type) per tuberculosis death. Where the registration under conditions usually prevailing at present does not reach this level, it may surely be assumed to be insufficient. But wherever final control begins to be within sight, a stage would be reached when the deaths are mostly of old cases, while new cases are becoming more rare. In the meantime, there should certainly be more than five known living cases per death and generally also more than two new cases per death. It is, of course, important to know whether or not hilum cases are included, but it seems that they ought to be on the register so that they can be watched and so that something can be done about them. Frequently, the distinction of type cannot be obtained and the data will suffer from this limitation.

The New Haven tuberculosis register, which includes the hilum type, counts about twenty cases per resident death, and the Danish register eleven pulmonary cases per death. This level may even be increased for some time through the extension of the life of tuberculous patients by improved methods of treatment (collapse therapy in advanced cases, *et cetera*). The number of new cases per resident death may increase to three or four before a definite decline, reflecting an approaching final success, sets in.

The Appraisal Form contains a note to the effect that, in establishing these ratios, correction should be made, if possible, for residents dying away from the city and for nonresident deaths and cases. This is insufficient. Records of tuberculosis deaths are worthless if not corrected for residence, because tuberculous patients generally do not die at home. Uncorrected records should be discarded and no ratios should be based on them.

Insofar as a check is concerned, the ratio of new cases and cases on the register to resident deaths merely gives an indication of whether or not the reporting is any good at all. The question of the ratio of new cases to cases on the register has been dealt with under Part A.

A better test of the completeness of the register will be had by the percentage of resident tuberculosis deaths not found on it. To this may be added a statement of the percentage of deaths which were reported less than six months previous to death. Cases thus reported were evidently reported too late to do anything much to save them, although some work on contacts might be done.

Another check is afforded by a tabulation of the source of notification. Clinics, sanatoria, and other institutions can easily be made to report cases and generally do so, but practicing physicians frequently do not report, especially if the patient is not likely to become a public charge. If, therefore, a fair proportion of the notifications does not come from private practitioners, the reporting may be assumed to be incomplete and steps should be taken to assure improvements. What may be considered a fair proportion, depends to some extent on local conditions.

It is important that tuberculosis registers should be verified every year in order to discard cases which are no longer on the active list. The number on the records may otherwise be unduly large.

The questions concerning clinical service, field nursing, and institutional care are much the same in the Health Indices as in the Appraisal Form.

C-IX. *General Public Health Nursing.* Reference to public health nursing is made under each subject—epidemic diseases, tuberculosis, child hygiene, *et cetera*. In view of the great importance of the nursing service in any public health program and as it is frequently the same nurses taking care of cases of different description, it has been thought advisable to include a recapitulation of all public health nursing activities without distinction of subject.

C-X. *Maternity Hygiene.* The Appraisal Form divides this chapter into: obstetrical service, medical health conferences, field nursing service, and community health instruction. It is proposed in the Health Indices to follow the chronological order of events, and the following sections are proposed: prenatal care, measures concerning pregnant women working in factories, obstetrical service, and postpartum care.

The subject is well covered by the Appraisal Form, except that it would be useful to add more information concerning the deliveries made in the homes. It seems important to obtain information concerning the nature of the obstetrical assistance given in the home and especially whether it was given by a qualified obstetrician or by an ordinary practicing physician. An attempt should be made to ascertain the maternal mortality according to the various types of obstetrical assistance.

C-XI. *Infant and Preschool Hygiene.* The Appraisal Form chapters on infant hygiene and preschool hygiene have been combined into one as the work is usually done by the same agencies and statistics frequently cannot be given separately for the two.

This chapter of the Health Indices has been divided into: clinics and medical care; nursing service; provision of milk for infants; supervision of illegitimate, boarded-out, and neglected infants and children; and preschool round-up. The information required is not very different from that of the Appraisal Form, but the tabular arrangement is new.

C-XII. *School Hygiene.* The Appraisal Form is very complete

so far as the observation and medical examination of the school children is concerned. It is proposed to add in the Health Indices information concerning recreation and physical training, school kitchens and meals at school, and provision for summer holidays in the country for city children. These three elements cannot be neglected in the building-up of health, especially among poor city children. The school kitchen has furthermore a utility which goes much beyond school hygiene, being a promising method of diffusing knowledge of rational nutrition, at least for the next generation when the present schoolgirls shall become housewives and mothers. The question of provisions for proper utilization of the summer holidays has been neglected in most countries, but the question should be posed in view of the excellent results obtained in certain localities and notably in Copenhagen, where some forty years of experience is now available.

C-XIII. *Physical Education.* Physical education does not come within the scope of the Appraisal Form, and it is clear that the subject cannot be dealt with in detail here. There can be no doubt, however, that it is a powerful aid in the building-up of the health of children and young people. It has been thought useful, therefore, to include very summary information concerning the active membership of scout and other organizations supervising physical education outside of schools. Questions have also been included concerning gymnasias, swimming pools, and playgrounds.

C-XIV. *General Sanitation.* While covering approximately the same ground as the Appraisal Form, it has been thought advisable to add a few more questions. It seems necessary to make mention of the source and treatment of the municipal water supply. The consumption of water per capita may also be of interest in showing the sufficiency of the supplies, although, in most towns, there is a good deal of waste, so that the consumption is really greater than the actual needs. The important questions as to the extent to which houses are supplied with municipal water and the frequency

of analyses of it are already included in the Appraisal Form.

The Appraisal Form chapter on sewerage includes only two questions: the percentage of dwellings connected with street sewers, and the percentage of unsewered dwellings having other satisfactory arrangements. The remainder of the subject of sewage and refuse disposal is not dealt with in the Form because, in the United States, these questions usually do not come within the competence of the health department. These subjects cannot be omitted, however, from a general sanitary survey, in which must figure the essential information concerning the treatment and the disposal of the sewage, garbage, and other refuse. Omission to inquire into those problems, together with other questions of sanitation, conveys too easily the impression that nothing need be done in these respects. Their omission in the Appraisal Form may not be entirely without responsibility for the fact that, in many American cities having otherwise an excellent health program, the methods of sewage and garbage disposal are unsatisfactory and antiquated.

*C-XV. Food Inspection and Nutrition.* Food and milk inspection and control of food handlers are usually exceptionally thorough and efficient in the United States. The Appraisal Form questions are therefore very complete in this respect and it has been thought possible even to abbreviate some of them in the Health Indices. It would seem useful nevertheless to add a question as to the medical examination of food handlers and another one concerning the tuberculin testing of dairy cattle. For many countries where much milk is sold unbottled, it would seem useful also to add a question concerning the proportion of milk sold in sealed bottles. The control of the shellfish trade might also be touched upon.

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This completes the subjects dealt with in the American Appraisal Form. It will depend upon the policies to be adopted by the Committee on Administrative Practice of the American Public Health Association, whether any of the following subjects will be included



in a future revision of the Appraisal Form. It is the opinion of the authors of the present Health Indices that housing and industrial hygiene must form integral parts of future health programs and cannot be neglected in a health survey. It is their opinion, fortified by current European health practice, that the question of medical care—in the home as well as in institutions—must also be covered.

C-XVI. *Housing*. The question of the quality and the amount of housing available has been dealt with in Part B. The present chapter therefore inquires only into the provisions made for town planning and the improvement of housing. The proposed sections are: housing survey, town planning and slum reduction, standards for new buildings, and inspection of premises. The first two sections concern planning; the second two, current activities which are already carried on in nearly all cities.

C-XVII. *Industrial Hygiene*. Legislation concerning industrial hygiene has mostly come into being largely through a collaboration of labor and employers' organizations with the state. It is therefore usually national or state legislation which is not part of the local public health programs. Much of it concerns health directly, but by no means all of it, and it is difficult to separate the health part from the remainder. Accident prevention is of concern in the conservation of health just as much as disease prevention and should not be overlooked. The regulation of the work of women and minors has also a repercussion upon their health and so has the hygiene of the premises in general. It is better, therefore, to include too much than too little. It should be remembered that the average man spends nearly one-third of his time, and many men spend more than that, at the workplace. The conditions under which the work is carried out cannot therefore fail to affect profoundly the health of the worker.

The sections of this chapter are: size of plants according to number of employed persons, factory and workshop inspection, medical examination of workers, prevention and compensation for indus-

trial accidents, prevention of occupational diseases, work of women and minors, and supervision of home work.

The object of this part of the indices is to obtain a brief survey of action taken in regard to such conditions in industry and other branches of employment as are likely to have a direct influence upon health. The indices suggested are therefore not the same as those contained in Dr. Leverett D. Bristol's Appraisal Form for Industrial Health Service. The principal purpose of Dr. Bristol's form is to appraise the "development of modern industrial health practice *in a company* or any unit of the same" and to promote such health work. The principal chapters of this form are:

- A. Vital Statistics Activities
- B. Communicable Disease Control
- C. Tuberculosis Control
- D. Occupational Disease and Accident Control
- E. Personal and Environmental Hygiene of Office, Shop, Store, Factory, and Outdoor Fieldworkers
- F. General Health Publicity

There is also a brief form for smaller concerns and a special form for the personnel and industrial relations service in general. The forms are thus meant for the use of the individual company which takes an interest in and acts to safeguard the health and welfare of its personnel and not for the appraisal of industrial hygiene from a community point of view.

C-XVIII. *Health Instruction.* In the American Appraisal Form, information relating to health publicity and education is given separately in each chapter of major activities; in the Health Indices, this has been gathered into a single chapter. This has been done because much of the health instruction is of a general nature and cannot be divided among specific categories; also because it seems necessary to add several subjects not mentioned in the Appraisal Form. Such subjects are: cancer, colds and pneumonia, nutrition, physical education, industrial hygiene, and accident prevention.

It has been thought advisable not to give special prominence to the distribution of printed matter, because, in our opinion, the number of copies of such material distributed means very little in itself. Instead, a table summarizes how far the various subjects have been covered by each of the following methods: leaflets distributed, cinema or exhibits, lectures or demonstrations, posters and newspaper publicity, teaching in schools.

C-XIX to XXIV. *Medical Care.* The last chapters of the Health Indices relate in brief form to the facilities for institutional or other organized medical care. There is the question of the care of the insane and feeble-minded which presents itself with different aspects for adults and for children. This question will frequently be found difficult to deal with in local surveys because the institutional care is usually organized on a state or provincial basis. If so, it will be necessary to estimate the share of the city in the total of available facilities.

A numerical expression of available facilities is more readily established for hospitals and similar institutions. Nevertheless, it happens frequently that hospitals of a minor town also serve the suburban area or even more distant rural districts. This is nearly always the case with tuberculosis institutions. There should be little difficulty, however, in such cases to determine the share of accommodations available for or used by the city.

The questions concerning health and invalidity insurance and free medical assistance are of a general nature. There is no intention here to go into any details of their organization. The simple numerical expressions for their coverage and the scope and magnitude of such activities will, however, materially assist in an appreciation of how far medical care is being systematically supplied to the part of the population that could not afford or would hesitate to apply for ordinary medical care. When the Health Indices are applied to specific problems it should not be difficult to devise measurements appropriate to the needs.

# ANNOTATIONS

## WORLD POPULATION: PAST GROWTH AND PRESENT TRENDS<sup>1</sup>

IN the opening paragraph of *WORLD POPULATION: PAST GROWTH AND PRESENT TRENDS*, Carr-Saunders states that he will attempt "to reconstruct population history and to describe the present population situation." Such a task seems almost beyond the scope of one volume, but the author has, in some three hundred pages, summarized and interpreted the facts about population in relationship to the economic and social conditions of individual countries and the world. Although his primary purpose is to describe population growth, he uses freely his knowledge of the social sciences to create a background which throws into clear relief his significant statistical analyses.

This book provides a veritable lecture course, which begins with a description of the techniques and sources necessary to study "how men count themselves," and takes the reader by gradual steps into the complexities of a world where some countries claim that population pressure can only be solved by colonization. With clear exposition the author discusses our limited knowledge of the growth of various countries, considers migration, births, deaths, and natural increase.

There follows a picture of the situation in Europe. As a basis for prediction, he uses the net reproduction rate applied by Kuczynski. The author believes, from calculations made on the birth rates of today, that the maximum population of Europe is coming at an earlier date and will be followed by a more rapid decline than most experts predict. Before 1950 the population in most countries in northern and western Europe will be on the decline. This assumes that fertility in the east and south of Europe will imitate the downward trend of the birth rate in the west.

<sup>1</sup> Carr-Saunders, A. M.: *WORLD POPULATION: PAST GROWTH AND PRESENT TRENDS*. Oxford, The Clarendon Press, 1936. 336 pp.

Noting that where fertility has begun to decline latest, it has fallen most rapidly, the low level for these sections will be reached in less time than in the west.

It is observed that there can be speculation on the future of mortality and fertility, governing the course of population. There is not much doubt concerning future trends in mortality because men will benefit from research in public health. On the other hand, he regards as small in scope the chances for increasing the number of births through prolongation of life during the child-bearing period. Whatever improvement in mortality rates may come in the upper age limits, existing but not potential numbers will be affected. The future of fertility is not so certain, but events in Europe during the last century lead him to think that fertility will decline steadily for some time to come.

A detailed consideration of the extent and regulation of migration to the western hemisphere is given. The difficulties in assimilation of immigrants are analyzed, including factors of psychological, physical, genetic, and economic nature. The author states that it is both "the right and the duty" of the government of any country to regulate migration on two grounds: (1) to avoid the waste, friction, and disappointment of the old individual "hit-or-miss" migration, and (2) to take steps to assure that those admitted are assimilated. An interesting, but necessarily inexhaustive, consideration of the feeling of nations that have been affected by such restrictions follows, and mention is made of the nationalistic bluster of countries with a "racial" or "cultural" message.

Two of the most stimulating chapters are those on attempts to raise the birth rate and on the small family problem. Decline in fertility is mainly due to voluntary limitation. It is felt that attempts to raise the birth rate in France, Belgium, and Italy may have retarded decline, but beyond this little can be said for their effectiveness. The rise of the rate in Germany may represent a rise in fertility or may simply denote the stimulation of a large number of first born in a short period of time. From this analysis of countries offering social or economic inducements to have larger families, the author concludes that there is little hope of this method counteracting the declining birth rate of European peoples.

The small family problem exists when fertility is so low that a population is not replacing itself. The little known psychological attitudes towards marriage, the family, child-birth, and the social and economic

encumbrances which children involve are discussed in a thought provoking manner. In his genuine concern over the failure of England to replace its population, however, he reverts to the alarmism frequently voiced by other students. Inasmuch as parents can prevent or postpone children, there is no guarantee that enough babies will be born to prevent a declining population from extinction. The author would not dispense with birth control, but he would impress upon the country the dangers of a declining population. He feels the need for "social reconstruction" towards meeting an urgent situation.

Because of the scarcity of reliable figures on the population of Asiatic and African countries, little space is devoted to them. Limitations of available data and possibilities of future trends are set forth, providing an excellent summary for the student.

Carr-Saunders' *WORLD POPULATION* is a valuable source and is also a timely book, picturing as it does the present situation. Those concerned with population problems and with the impact of nationalism on population policy will find this a stimulating book.

SARA C. BRIGHT

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### DIET AND THE TEETH<sup>1</sup>

THE publication of the final report of the Committee for the Investigation of Dental Disease is the fourth in a series of important contributions, by May Mellanby and her co-workers, to the literature of dental decay. In 1929 Mrs. Mellanby demonstrated that deficiencies of calcium, phosphorus, and Vitamin D in the diet of young dogs produce marked deleterious effects on the structure of the developing teeth. In 1930 the findings were augmented by demonstrating similar effects of like dietary deficiencies on the teeth of rats, rabbits, and monkeys. A third report (1934), which contained an extension to children of the previous experimental work, indicated that a direct relationship exists between defective dental structure (hypoplasia) and tooth decay. While Mrs. Mellanby's theories, offered in explanation of the etiology of dental de-

<sup>1</sup> The Influence of Diet on Caries in Children's Teeth. (Final Report.) The Committee for the Investigation of Dental Disease (Assisted by Alan Deverall and Mable Reynolds) Special Report Series No. 211, Medical Research Council, London, 1936.

cay, are not accepted completely by other workers, there is general agreement for the view, held by a number of other investigators, that an adequate diet well fortified with calcium, phosphorus, and Vitamin D inhibits the progress and delays the onset of tooth decay in children. The final report which describes the findings of three investigations, offers additional evidence in this latter connection.

In a first investigation, three groups of children from 5-14 years of age, living in three separate institutions, were fed approximately the same basal diet for three years with certain dietary supplements. In one group of forty-four children, each child received a daily supplement of 1-1½ ounces of golden syrup. At the end of the three-year feeding period an absolute increase of 14.2 per cent in the number of carious teeth was noted. In the second group of fifty-five children, each receiving a daily supplement of olive oil, there was found an absolute increase of 11 per cent of carious teeth. A third group of seventy-five, each of whom received cod liver oil daily, showed an absolute increase of 9.2 per cent of teeth having carious defects.

In the second investigation, conducted in one institution, two groups of children from 5-14 years of age were fed an adequate basal diet plus daily supplements. One subdivision of this group of children (fifty-nine in number) received olive oil supplements for two and one-half years. These children showed an absolute increase of 13.8 per cent of permanent carious teeth. The second group of sixty children fed daily supplements of a mixture of olive oil and irradiated ergosterol for the same length of time, showed an absolute percentage increase of carious permanent teeth of 8.0.

In the third investigation, three groups of children, all under five years of age, were studied for two and one-half years. At the end of this time, thirty-one children receiving daily supplements of golden syrup developed an absolute percentage increase of 6.6 in teeth showing caries. A second group of thirty-one, fed Vitamin D daily, showed an increase of 4.0 per cent and a third group of thirty-eight, fed cod liver oil daily, developed the least amount of new caries, showing an increase of 3.3 per cent.

The data in the report are subjected to conventional statistical analyses and the differences in incidence of tooth decay in the various experimental groups are considered significant. The report concludes with the statement that "a relatively high Vitamin D content of the food can do much



to diminish the incidence of caries, if the vitamin is given during the development of the teeth; that a beneficial effect may be obtained if the vitamin is given at a fairly late stage of development; and that, even when it is given after the eruption of the teeth, the onset and spread of caries is delayed."

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